Multiple Criteria Decision Making for Supplier Selection and Cross-Cultural Considerations: Case Study of the United Kingdom / United Arab Emirates Construction Industry

Submitted by **Ousha Saeed Alshamsi**,
to the University of Exeter as a thesis for the degree of Doctor of Philosophy in Engineering, in **October 2019**.

I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

Signature: .....

ACKNOWLEDGEMENT

First and foremost, I would like to thank all those who have helped, encouraged and inspired me throughout my Ph.D. study and have made this thesis achievable. I would like to thank my supervisor, David Zhang, and express my appreciation for his continuing support during my research journey.

Furthermore, I am grateful for my country, the United Arab Emirates, for helping me to be a student at this great university and to reach my goal.

I would like to thank my family: my mother, sisters, brothers and all my nieces and nephews for supporting me in all aspects throughout my doctoral degree journey. Also, my thanks go to my friends, especially my friend on the research journey, Mai Aldhaheri, for being with me during my studies in the UK and for her continuous support.

Last but not least, I would like to dedicate this success to the soul of my father and my beloved sister Nassra (Allah rest their souls), who never stopped giving advice, encouragement, and support throughout my whole study. I hope that they were with us to share my happiness with this achievement.

ABSTRACT

Supplier selection is an essential part of business activity in the supply chain. The failure or success of organisations depends on suppliers and their attributes. As the supply chains become increasingly globalised, supplier selection requires an understanding of cross-cultural differences in decision-making. Supplier selection is based on well-established criteria that can differ between industries and individuals, and the perceived importance of supplier attributes as selection criteria drive the decision process.

The main objectives of the current research were to investigate the levels of importance attributed to the selection criteria and sub-criteria. The research also aimed to reveal differences in supplier selection between two cultural groups, specifically the United Kingdom (UK) and the United Arab Emirates (UAE). Additionally, this research aimed to examine the key supplier selection criteria from the construction industry. This industry was selected due to its important contribution to the national economies of the UK and UAE. Furthermore, the research aimed to develop a mathematical model for the supplier selection process that can be employed in the construction industry to address gaps in previous studies. Prior studies argued that the development of a simple mathematical model would facilitate a better understanding of supplier selection process.

To achieve the above goals, the current research employed a mixed research method. It used qualitative and quantitative research methods. Interviews were used for the qualitative method, while a questionnaire was used for the quantitative method. The supplier selection decision makers were approached to participate in the research. These decision makers consisted of the chief executive officer or president, purchasing managers, supply chain managers, operation managers, and logistics managers. There were 100 research participants: 50 participants from each country (the UK and UAE). They were interviewed and filled in the questionnaire. Qualitative data was analysed with thematic analysis and the quantitative data was analysed with Analytic Hierarchy Process (AHP).

The current research found that previous studies focused on quality, cost and price, delivery, and other factors as the critical supplier selection criteria. It was also found

that previous studies ignored the cultural attributes and corporate social responsibility selection criteria. It was found that previous studies had not examined the construction industry, especially from two different regions with alternative cultural values. After analysing collected data, the current research found that the most important supplier selection criteria in the construction industry are financial position and quality management system. Complementarily, the results showed that there were similarities and significant differences between the UK and UAE in terms of the importance of selection criteria. The results also showed that there was a further similarity between green practices and supplier logistics. The results revealed that the cultural attributes of suppliers were the least important selection criteria compared with the other criteria available in the current research framework. Meanwhile, the results noted there was a cultural influence on the supplier selection process.

The results of the current research increase our understanding of the supplier selection criteria, and the cultural influence on the selection decision-making, especially in the construction industry. Additionally, the current research provides a framework of the most important selection criteria for suppliers in the construction industry. The framework is rooted in supply chain management literature, transaction cost theory, institutionalisation theory, and agency theory. This framework consists of nine main criteria and 44 sub-criteria. It was used to develop a mathematical model. The model is a part of the multiple criteria decision-making (MCDM) technique. The current research model is based on the Saaty (1980) model, which scores and weighs the list of the criteria and sub-criteria. The model can be used to calculate the overall score for each supplier. Thus, the model can enhance the supplier selection decision-making process.

Therefore, the current research contributes to the theory of supply chain management in the area of supplier selection. It also contributes to the supply chain management of the construction industry as a general body. Ultimately, the research contributes to the practice of supplier selection in the construction industry, specifically in the UK and UAE.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AHP	Analytic Hierarchy Process
ANOVA	Analysis of variance
CA	Cluster Analysis
CBR	Case-Based Reasoning
CI	Consistency Index
CR	Consistency Ratio
CSR	Corporate Social Responsibility
DEA	Data Envelopment Analysis
DEMATEL	Decision-making trial and evaluation laboratory.
GDP	Gross domestic product
GSCM	Green supply chain management
KMV	Key Mediating Variable
LCCS	Low-Cost Country Sourcing
LP	Linear Programming
LSD	Least significant difference
MADM	Multi-Attribute Decision-Making
MAUT	Multi-Attribute Utility Theory
MCDM	Multiple Criteria Decision-Making
MP	Mathematical Programming
MAUM	Multi-Attribute Utility Methods
NN	Neural Networks
PCA	Principal Component Analysis
RI	Random Index
SCM	Supply Chain Management
SSCM	Supplier Supply Chain Management
TCT	Transaction Cost Theory
TOPSIS	Technique for Order Preference by Similarity to Ideal Solutions
UAE	United Arab Emirates
UAEU	United Arab Emirates University
UK	United Kingdom
USA	United States

CHAPTER 1: INTRODUCTION

Most companies, in different industries, place a great deal of time and investment in their operations. Managing their supply chains and selecting the right suppliers are among the strategies to minimise their costs. Consequently, an effective selection of suppliers is a means of reducing costs in the construction industry (Zavadskas et al., 2010, p. 35). One of the compelling reasons for the proper selection of suppliers by businesses is that there is an increasing dependence on suppliers to improve overall organisational performance (Sarkis & Talluri, 2002). In respect to the critical role of suppliers on the company's performance, Vonderembse and Tracey (1999) argued that more organisations identify and use definite supplier selection criteria to streamline productivity within the organization. These scholars and others, such as Amorim et al. (2016), Beikkhakhian et al. (2015), and Mwikali and Kavale (2012), argued further that the supplier selection process is significantly improved with right selection criteria. Therefore, this research focuses on the important selection criteria for suppliers. It examines how these criteria influence decision makers when selecting their suppliers. It also examines the effects of cultural attributes in supplier selection decision-making.

Supplier selection management is an important issue to consider in the construction industry. This industry is one of the sectors that deals with the expensive cost of production. The industry requires construction materials that are highly expensive due to non-constant purchases. The industry is now geared towards realising cost efficiency (Zavadskas et al., 2010, p. 34). Accordingly, the industry embraces supply chain management (SCM) to facilitate the realisation of project goals, reduce operational costs, and ensure efficiency (Tan et al., 1998, p. 3). Thus, supplier selection becomes a crucial concept in the SCM of the construction industry.

The construction industry continues to attract the attention of researchers because it is one of the fundamental drivers of national economies (Razzaq et al., 2018; Yong & Mustaffa, 2012). For example, in 2017, the industry's contribution to the United Kingdom's (UK) economy was 6%. This was equal to £113 billion (Rhodes, 2018). Similarly, in the third quarter of 2018, the industry's contribution was 14%. There has been continuous growth in the construction sector. Likewise, in the United Arab Emirates (UAE), the industry is rapidly developing due to the massive investment in construction developments, which directly affects overall national growth. In 2008, the

construction industry's contribution to the gross domestic product (GDP) in the UAE was 10.6%, and in 2011 it was 10.3% (Dubai Chamber of Commerce, 2012). According to Construction Week Online (2015), there were expectations that the construction industry in the UAE would grow from 11.1% to 11.5% of GDP between 2015 and 2021.

Based on the importance of the construction industry and its effects on national growth and development, this research focuses on construction companies in the UK and UAE. In engaging the UK and UAE as viable case studies, the research analysed the supply structures of the construction industry in both countries. The construction industry in these two countries represents two different regions (Europe and the Middle East). These regions have several construction companies (Sarkar et al., 2018). The construction industry of the UK and UAE is made up of customers, competitors, the environment, stakeholders, staff, and government (Molamohamadi et al., 2013, p. 280).

The UK and UAE are large countries in their respective regions, and they reflect different capabilities in terms of construction developments. Meanwhile, there are limited studies that have attempted to compare the supplier selection between such large markets (Kannan & Tan, 2003, p. 474). Similarly, there is a limited study on the effects of cultural factors on the selection of suppliers in the construction industry in these countries (Goebel et al., 2012). The scarcity of studies comparing the two different large economies, and their different supply chain structures and cultures justify the need for a more in-depth inquiry on the selection criteria for suppliers in the construction industry. Thus, this research explores multiple selection criteria for suppliers in the UK and UAE by focusing on the influences of cultural factors.

1.1 Background and Scope of the Research

Supply Chain Management (SCM) is the management and incorporation of the organisation and supply chain activities using efficient business processes, mutual organisational relationships, and information sharing. Involving SCM in the organisation provides high-performing value systems that allow the organisation to have a sustainable competitive advantage (Handfield & Bechtel, 2002). One of the purposes of SCM is to obtain effectiveness in the activities of the supply chain at all essential levels (Handfield, 2006).

In today's globally competitive environment, business organisations are striving to find and adopt new methodologies that can help them to survive and sustain their current performance levels. Products and projects are becoming more and more complicated. Due to this complexity, no business organisation can produce its products or services internally. It is challenging for one company to manufacture all the required sub-components or raw materials for its final products. To realise sustainability, such organisations have had to downsize, focus on core competencies, and leverage on the suppliers and technologies to attain competitive advantage (Černá & Buková, 2016; Kannan & Tan, 2002). Hence, there will always be a necessity to utilise subcontractors or suppliers (Salam & Khan, 2018, p. 4084). Meanwhile, the quality of a final product depends mainly on the quality of the supplied materials. Thus, the selection of qualified suppliers is a crucial organisational task. According to Safa et al. (2014), the construction industry is a multidisciplinary field that is based on the continued correspondence between different stakeholders to ensure that the products reach the intended market (p. 65). Thus, it is essential in the construction industry to recruit, evaluate and select competent suppliers.

Therefore, the supplier selection and evaluation processes are important as they determine the success or failure of the organisational supply chain (Sarkis & Talluri, 2002). In the construction industry, the absence of on-site materials may lead to delays and an increase in production costs, which negate the progress of the company (Safa et al., 2014, p. 65). Beyond the production and sustenance of low-cost operations, effective supplier selection facilitates the mitigation of the waste that results from manufacturing and construction activities (Safa et al., 2014, p. 66). The supplier selection process involves ranking suppliers and includes them on a qualified supplier list. The four significant phases of construction projects are the design, building, construction, and completion phases (Zavadskas et al., 2010, p. 37). These phases represent the life cycle of construction. Each phase requires these activities: problem definition, formulation of criteria, qualification, and final choice of suppliers (Lima-Junior & Carpinetti, 2016, p. 270). For a better explanation, in the first phase, the company administration identifies what materials or equipment they need to release for their current project. Then, the administration formulates different criteria to assess the potential suppliers, and they finally evaluate new or existing suppliers. Thus, supplier evaluation involves examining a group of suppliers in a specific tender and choosing

the best one. It is vital, in the supplier selection process, to ensure that the selected supplier can offer good aftersales services, maintenance, and spare parts.

Traditionally, the supplier selection and evaluation were based on price and quality and other commonly accepted attributes (Cengiz et al., 2017; Rezaei et al., 2016; Weber et al., 1991). However, these criteria are not sufficient in today's business environment (Mukherjee, 2014; Zouggari & Benyoucef, 2012). Thus, multiple criteria are suggested by scholars and practitioners, such as Amorim et al. (2016), Beikkhakhian et al. (2015), and Mwikali and Kavale (2012). The multiple criteria strategy has led to the use of multiple criteria decision-making (MCDM) techniques to evaluate and select competent suppliers. Examples of the MCDM techniques are multi-attribute utility methods (MAUMs), outranking methods, and compromise methods (Chain & Ngai, 2020, p. 4). The use of MCDM involves making decisions by considering several criteria. It is concerned with the identification of the best supplier and overcoming supplier management challenges. Primarily, MCDM methodologies help the organisations to make decisions that optimally satisfy predefined criteria that are created and evaluated by the decision makers (Azadfallah, 2017, p. 24). Moreover, MCDM considered as one of the common solutions to the supplier selection and evaluation problem (Dickson, 1966).

Supporting the importance of MCDM, Kannan and Tan (2006) stated that any positive results from a buyer–supplier relationship can be directly traced to the supplier criteria that was applied (p. 4). Tracey and Chong (2001) added that MCDM is a viable modelling framework that can enable efficiency in the buyer–supplier relationship. These scholars noted that failure would be inevitable if the suppliers were not chosen carefully to satisfy the corporate objectives. In respect to the arguments of Kannan and Tan (2006), Tracey and Chong (2001), and other above-mentioned scholars on MCDM, it can be established that there is a positive relationship between the selection criteria for the supplier and achieving optimal outcomes. Therefore, the current research investigates multiple criteria in the construction industry of the UK and UAE by focusing on cultural factors.

Furthermore, the current research employed transaction cost theory (TCT), institutionalisation theory and agency theory. These theories are widely used in SCM studies, such as Kanwal and Rajput (2016), Fayezi et al. (2012), and Grewal and

Dharwadkar (2002). TCT was used because the theory focuses on how the cost of transactions impacts overall operational costs. Grover and Malhotra (2003) explained that TCT theoretically assumes that every cost of any operation affects the overall total costs. Hence, if the arguments of Cengiz et al. (2017), Rezaei et al. (2016), and Weber et al. (1991) about the importance of cost and prices as the main supplier selection criterion could be considered, TCT seems to be relevant for the current research. The institutionalisation theory was used because Bozarth (2008), Lainez et al. (2008) and Handfield & Nichols Jr. (1999) argued that SCM is a sub-institution in an organisation. These scholars explained that the supply chain unit is a linking pin that connects other units. These scholars pinpointed that better performance of the supply chain unit indicates a better overall performance of the entire organisation. Similarly, Grewal and Dharwadkar (2002) stated that the institutional theory proposes that every unit, values, and culture of an organisation must be aligned if the goals are to be achieved. Considering the explanations of the scholars of SCM and institutional theory, the theory seems to be relevant to the current research.

In addition to the above, SCM's scholars, including Pienaar (2009), Handfield (2006), Burt et al. (2003) and Mentzer et al. (2001), explained that there is supposed to be a relationship between the supplier and buying organisation. This relationship could be interpreted as an 'agent–principal' relationship. In this interpretation, the agent refers to the supplier, while the principal refers to the buying organisation. In this respect, the agency theory is relevant. The main theoretical assumption of the theory is that it seeks to establish a relationship or investigate the nature of relationship existing among different stakeholders of an organisation or institution, according to Zsidisin and Ellram (2003) and Cousins et al. (2006). This assumption delineates that the theory could be applied to supplier selection, as it was tried by Heracleous and Lan (2012) and Simatupang and Sridharan (2002).

Based on the above background and its theories, the scope of the current research covers the supplier selection process in SCM. Specifically, it focuses on the multiple selection criteria in a specific context. The context of the research is the construction sector in the UK and UAE. As established earlier in this section, supplier selection is very important in the construction industry. Similarly, construction companies play important roles in the economy of the UK and the UAE. The UK and UAE are also

important economies in their regions. Hence, the context of the current research is suitable for in-depth knowledge of supplier selection management.

1.2 The Research Problem Statement

Several scholarly works, such as Salam and Khan (2018), Rojniruttikul (2017), Trapp and Sarkis (2016), Polat and Eray (2015), Waris et al. (2014) and Azadnia et al. (2012), established that multiple selection criteria are highly needed. However, these previous works did not focus on the 'most important' selection criteria. Considering the importance and nature of the construction industry in the UK and UAE, it can be agreed that there is a need to establish a comprehensive list of supplier selection criteria. The list is expected to include all critical criteria that affect the supplier selection decision in different business organisations, as recommended by Chai and Ngai (2020). According to Guarnieri and Trojan (2019), criteria such as performance history and delivery, the reputation of the supplier, innovation and creativity, amount of past business, marketing position, and supplier expertise need to be included. These scholars noted that these criteria are not currently considered in the literature. Therefore, there is a need to examine different selection criteria and define the most important one among them.

There are several different models for supplier selection according to Sonmez (2006), De Boer et al. (2001) and Nydick and Hill (1992). Among the models are neural networks, case-based reasoning, total cost-based approach, non-linear programming, mixed integer programming, linear programming, and analytic hierarchy process (Aamodt & Plaza, 1994; Sonmez, 2006). The works of Saaty (1980, 1990, 1996, 2001), Bello (2003), Carter (2005), Rogers (2009), and Roshandel et al. (2013) asserted that developing models for supplier selection is among interesting research areas for scholars. However, there is not yet a model that considers cultural attributes for supplier selection. To be precise, no model considers the cultural influence of decision makers for supplier selection as well as the cultural factors of the suppliers themselves. Although, Carter (2005) noted that cultural attributes may influence decision-making, the consideration of culture as a factor for both decision makers and suppliers has been neglected by the literature. Therefore, it is essential to investigate this aspect of supplier selection.

The consideration of culture extends to patriotism and nationalistic elements, as well as corporate social responsibility (CSR) according to Becker and El-Said (2013) and Rose (2001). It is argued by Rose (2001) that many supplier selection decision makers show a positive interest in buying locally made materials. Livanis et al. (2016) also argued that patriotism and nationalism have an impact on the supplier selection process. Thus, there is a need to include patriotism as a cultural criterion. Presently, there is limited scholarly work on it.

Apart from the above, Timmerman (1986a) stated that a mathematical model was needed for supplier selection. Recent works from Feurtey et al. (2016), Yildiz and Yayla (2015) and Dubey et al. (2015) argued that a mathematical model facilitates the supplier selection. Thanki et al. (2016), Beikkhakhian et al. (2015), Deng et al. (2014), Barla (2003) and Saaty (1980) proposed different mathematical models. These models are quantitative applications that aimed to achieve and evaluate the supplier's score purposely to choose the best supplier. The models also weigh each criterion or sub-criterion differently. Meanwhile, Sonmez (2006) noted that the models have a common disadvantage, which is a limitation to the quantitative criteria. Winston (2002) argued that the complexity of using most of the mathematical programming (MP) models is another major problem for many operating managers. For example, multivariate statistical analysis requires a good understanding of advanced statistical techniques. Moreover, using artificial-intelligence-based model software needs a qualified expert who must be aware of previous similar situations to reuse the knowledge and information. Therefore, there is a need for a simple mathematical model that can be used by scholars and practitioners in the construction industry.

Most interestingly, there are some scholarly works on supplier selection in some industries, such as the food industry (e.g. Amorim et al., 2016; Banaeian et al., 2016), automotive industry (e.g. Dweiri et al., 2016; Gupta et al., 2015; Shahroudi & Tonekaboni, 2012), energy industry (e.g. Feurtey et al., 2016), information and communication technologies (e.g. Gustin et al., 1997) and electronics industry (e.g. Degraeve & Roodhooft, 1999; Hirakubo & Kublin, 1998). There are a limited number of scholarly works on supplier selection in the construction industry. Likewise, there are limited comparative studies that examine different selection criteria in different countries. Therefore, there is a need to fill this research gap.

In summary, there is a need for scholarly work on MCDM for the construction industry. Similarly, there is a need to develop a mathematical model for MCDM for the industry. Such new mathematical formula can reduce the time and effort required in the supplier selection process, thereby minimising costs and improving the efficiency of the process. These needs propelled the current research.

1.3 Research Aims and Objectives

As established in the previous section, there are research gaps in the MCDM framework for the construction industry. Specifically, the framework requires definite industrial selection criteria, the inclusion of cultural factors and use of a mathematical model. Therefore, the main objective of the current research was to fill these gaps by proposing a new MCDM mathematical model that contains the most important supplier selection criteria for the construction industry.

This research aims to define the most important multiple selection criteria for the construction industry, as well as to outline the sub-criteria of each important criterion. It also seeks to compare these important criteria and sub-criteria for UAE and UK purchase decision makers. Although the selection criteria do not vary between different industries because supplier selection is mainly standardised in modern industries, the relative importance of these criteria differs from one industry to another and among decision makers. This research involves studying and analysing the complexity of these criteria, as well as the underlying mechanism that affects the supplier selection decision in the UK and UAE construction industries. The underlying mechanism seems to have a direct impact on company performance and efficiency (Rogers, 2009; Roshandel et al., 2013).

Similarly, the present research seeks to examine the cultural influences on supplier selection in the UK and UAE. In respect to the arguments of Livanis et al. (2016), Becker and El-Said (2013) and Rose (2001), cultural factors should be researched and considered in MCDM studies. Thus, this research assumes that adding cultural factors to the MCDM framework would enhance its practicality. Additionally, the present research seeks to examine how new criteria (suggested by Guarnieri & Trojan, 2019) would improve the MCDM framework. This research assumes that examining the

cultural influences on MCDM would provide a better understanding of the selection of suppliers for scholars and practitioners.

Furthermore, the current research aims to provide a mathematical model that can be used by scholars and practitioners in the construction industry. The mathematical model is essential in the industry as argued by Yildiz and Yayla (2015) and Dubey et al. (2015). Although there are many mathematical models for supplier selection, there is no similar model tailored to the construction industry. Similarly, some scholars, such as Sonmez (2006) and Winston (2002), have advised that complex mathematical models should be avoided. Consequently, the research aims to provide a simple mathematical model for the construction industry.

In summary, this research aims to achieve the following objectives:

- To examine the most important supplier selection criteria in the construction industry (in the UK and UAE).
- To examine the cultural influences on the supplier selection process in the construction industry
- To develop a mathematical model for supplier selection in the construction industry.

1.4 Research Questions

According to Azadfallah (2017), Kannan and Tan (2006), Tracey and Chong (2001), and Dickson (1966), multiple criteria are essential for better decision-making for the supplier selection. These scholars argued that the criteria should be comprehensive so that different factors could be verified during the supplier evaluation process. These scholars pinpointed that the more detailed the criteria, the better the decisions. Given this, the scholars, such as Deng et al. (2014), Barla (2003) and Saaty (1980), have provided models that facilitate multiple criteria. Meanwhile, it is noted that these scholars have not yet focused on the most important criteria. Understandably, the criteria should be comprehensive and wide enough so that many factors can be included. However, too many criteria might affect the quality of selected suppliers. Therefore, the current study posts its first research question as follows:

1. *What are the key selection criteria for suppliers in the construction industry in the UK and UAE?*

Having the key selection criteria is essential, but the 'understudied' criteria are also important. The cultural criterion is one of the understudied criteria. Chai and Ngai (2020), Guarnieri and Trojan (2019) and Carter (2005) stated that the cultural factors in determining decisions are critical for construction companies. These scholars explained that companies need to include some cultural criteria. They added that such criteria influence supplier selection. The scholars noted that selecting the right or competent suppliers is achieved by considering the networks and ethics of the suppliers. Meanwhile, the available literature has not discussed cultural criteria in the multiple criteria for supplier selection. Similarly, it has not considered cultural influences on the decision-making of suppliers in the construction industry from the UK and UAE. Thus, the current research asks the following question as its second research question:

2. *Do the cultural factors of the UK and UAE affect the supplier selection criteria and selection decision-making?*

The models propounded by Thanki et al. (2016), Beikkhakhian et al. (2015) and Saaty (1980) showed that different formula had been used to facilitate the selection evaluation process. The models showed that there were different criteria. Even though these models were employed and yielded some positive results for the MCDM, there is not yet a mathematical model that can be used for the construction industry in the UK and UAE. Hence, the current research posts the following question as to its third research question:

3. *What kind of mathematical model can be used for supplier selection criteria in the UK and UAE construction industries?*

The above research questions were investigated. The questions address the assessment of the UK and UAE supplier selection models within the construction industry. Notably, the current research is drawn from the contention that a supplier selection model is influenced by the social, ethical, and environmental factors that inform a particular economic setting (Guarnieri & Trojan, 2019, p. 348). Thus, it is

necessary to examine the different dynamics that are reflected in two different economic settings concerning their existing supplier selection models. The review of different supplier selection criteria intended to capitalise on the ethical and cultural elements that define different economic environments (Goebel et al., 2012, p. 9). Since the current research is focused on the construction industry, examining different supplier relationship management processes would lead to the establishment of models that can improve the industries (Lu & Geyao, 2010, p. 189; Aleo Jr., 1992). Some of the elements that the current research reviewed individually include the price, delivery, quality, engineering capability, and management systems. These criteria are found to inform supplier selection processes in the UK and UAE (Rojniruttikul, 2017, p. 189).

1.5 Structure of the Dissertation

This research consists of five chapters. The first chapter provides an introduction to the entire dissertation. It introduces the topic of the research, background, and scope of the research. The chapter also presents research problems and research questions. The aims and objectives of the research are also explained in the chapter.

The second chapter discusses different literature and presents the theoretical framework of the research. It reviews scholarly works on SCM, TCT, institutionalisation theory, agency theory, supplier management, the supplier selection key criteria, the supplier selection criteria models, the cultural factors, and the supplier selection decision-making models.

The third chapter presents the research methodology. It presents the research philosophy, research design, and research participants. It explains its research methods and instruments. It also explains the entire research process. The chapter elaborates on the data analysis process. It also elaborates on the research framework and mathematical model, as well as their validation.

The fourth chapter presents the results and discussion of the current research. The results are presented according to the research methods – qualitative and quantitative. The discussion subsection focuses on the most important selection criteria, decision

resemblance, and decision discrepancies. The chapter ends with the answers to the research questions.

The last chapter consists of a conclusion and suggestions for future work. The conclusion section explains the final opinions of the current researcher on the findings and the relationship of the findings with previous studies. The chapter also presents the contributions, implications, and limitations of the research. It ends with a list of proposals for future studies.

CHAPTER 2: THEORETICAL BACKGROUND

The supplier selection process is where a company identifies, assesses and enters into a contract with a supplier or suppliers. The process of supplier selection requires a company to deploy a significant amount of financial resources to get the suppliers that offer high value. Thus, construction companies invest a large amount of money in their operations. To ensure efficiency, these companies rely on outsourcing complex services and products to different suppliers. This means that if such a company needs to maintain or increase its place in the market, it has to choose the suppliers that increase its value. This makes the supplier selection process crucial for construction companies (Beil, 2009). An error in the supplier selection criteria is likely to jeopardise construction companies' operations. The error could result in reduced levels of cooperation and collaboration among the subject individuals (Mirmousa & Dehnavi, 2016, p. 282). Therefore, this reality demands the establishment and alignment of proper supplier selection criteria by companies to reflect their general goals as an organisation.

In this chapter, there is a general discourse on SCM, supply chains, and supplier selection criteria. It also covers the important supplier selection criteria and their models. Then the supplier selection theoretical framework of this research is introduced. The chapter details each criterion of the framework.

2.1 Supply Chain Management (SCM)

Pienaar (2009) describes a supply chain as a system of structure that describes the process integration which facilitates the transformation of raw materials into finished goods within the organization. Similarly, a supply chain is a group of linked and shared matters associated with streams of products, services, finances and knowledge (Harland, 1996; La Londe & Masters, 1994; Mentzer et al., 2001). Mentzer et al. (2001) presented a manufacturing supply chain, from the raw materials to the end customer, as shown in Figure 2.1. In their supply chain, the required raw materials and components are provided to the departments concerned from selected suppliers. The scholars explained further that financing and financial recommendations are provided by a financial provider and the logistics actions between the organisation and its customers are managed by a third-party logistics supplier. The scholars explained that

a market research organisation examines the attitudes of the end customers to provide the company with advice and recommendations for future improvements.

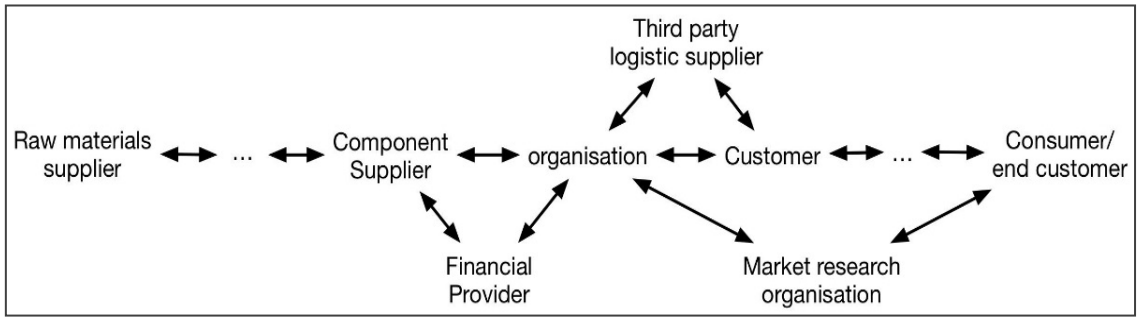


Figure 2.1 A Manufacturing Supply Chain (Adapted from Mentzer et al., 2001)

According to the above figure, SCM is an important concept that affects a company's overall performance. It aims to manage the supply chain network. In reflecting on the significance of SCM in the production process, Cooper et al. (1997) suggested that it encompasses all areas of the organisation to ensure the linearity of operations. This function is a competitive strategy that links the company with distributors and suppliers in a system called an inter-organisational system (Bozarth, 2008). In SCM, there are three levels of decision-making according to Hwang & Yoon (1981). The levels are strategic, tactical and operational. For strategic SCM, the management level is informed by the desire to make decisions around issues in the future. Essentially, the strategic level of SCM involves the preparation of a succinct plan which covers the whole of the supply chain process. According to Schmidt and Wilhelm (2000), the strategic level of decision-making in SCM identifies and prescribes the viable production locations, technologies, and capacity. The scholars of this decision are reflective. In summary, strategic SCM prescribes the viable steps and actions to be taken in ensuring that the network of supply chains meets the demands of the organisation in short and long runs. At the tactical level of decision-making in SCM, the initiative is started and maintained by lower-level staff. The main aim of this level is to define the actual actions that will be taken to realise the goals defined at the strategic level (Lainez et al., 2008). For example, tactical decision-making at the SCM level often entails production schedules and guides which reinforce the standards that have been embraced by the various sections to achieve optimality. Lastly, the operational level of decisions in SCM is equally necessary. It entails all day-to-day actions that sustain the supply chain within the given industry (Schmidt & Wilhelm, 2000). The level defines

figures and goals that are to be realised within a specified time frame. It may also inform the scheduling of payments that are due to suppliers. As a relevant resource, these three levels of decisions in SCM enhance the quality of relationships that exist between the companies (that can be regarded as principal) and the agents (that include suppliers). Such a contention underlines Narasimhan's (1983) call for the development of a model that achieves responsive judgement in relation to supplier selection processes. The three levels of decisions in supplier chain management seek to identify the best criteria to apply in realizing the intended outcomes of supply initiatives (Narasimhan, 1983; Hwang & Yoon, 1981).

Handfield and Nichols Jr. (1999) studied the roles and responsibilities of SCM in holding the organisation and activities of companies together. According to these authors, SCM can provide a lasting competitive advantage by maintaining cooperative knowledge sharing and organised relationships. The authors noted that such a competitive advantage can lead to a high-standard value system. Moreover, Handfield & Nichols Jr. (1999) mentioned three key topics to be considered in SCM: cost control, quality of the provided services, and objectives aiming to be reached. The authors concluded that effective and continuous targeted participation is the main objective of SCM, taking into consideration the supplier, manufacturer, distribution channel and warehouse.

Furthermore, SCM involves different management, planning and organisation activities. It includes also the activities of organising the relationship with the partners of the supply chain channel. The supply chain channel partners include customers, intermediaries, third-party service providers, and suppliers. The environment where professional supply chain management is carried out has special characteristics. This environment considers partnership with the global economy as a significant subject. The environment also considers the selection of suppliers that should be derived from mutual relationships with the best global suppliers. In other words, the selection of suppliers should be based on international long-term relationships (Bozarth, 2008; Burt et al., 2003; Schmidt & Wilhelm, 2000).

Finally, the traditional business aspect of 'buyer-seller' is the basic concept in SCM for supplier selection and relationship management. Thus, the parties relating to SCM are the supplier, buyer, manufacturer, distributor and end-user (Burt et al., 2003).

It can be noted from the above discussion that SCM works with both the supply and demand of any business organisation. The above discussion shows that SCM is the management of the relationship with other business organisations. The discussion emphasises that supplier selection is important in SCM. It reveals that supplier selection is essential at all levels of SCM decision-making. The discussion presents how a high-performance business model can be attained by connecting the main activities of an organisation, of which supplier selection is one, together. Therefore, it can be agreed that supplier selection can be understood by drawing on the theories and frameworks of SCM. The next subsections present and discuss a couple of theories and the theoretical framework of the current research.

2.2 Supply Chain Management Theories

Notably, several theories in SCM may be applied in explaining the concept of supplier selection and how it affects managerial decisions. These theories explain the nature of relationships that exist between SCM and the suppliers as stakeholders in the institutional functions. Meanwhile, this research focuses on how construction companies realise efficiency in their resource allocation. Thus, this research employed transaction cost theory (TCT). Similarly, the current research focuses on supplier selection, which is one of the institutions in SCM. It employed institutionalisation theory. This research concentrates on the suppliers that are usually the agents of the construction companies; thus, agency theory is employed.

2.2.1 Transaction Cost Theory (TCT)

TCT suggests that the costs of operations will likely increase in an organisational setting when external parties are contracted to oversee a function or task. It infers a link between the acquisition of a given supply product and the bearing of a cost by the involved organisation. According to Grover and Malhotra (2003), one of the underlying assumptions of TCT is that the cost of transactions affects the overall cost of operations and may be higher in situations where the cost of coordination is also higher. These scholars explained that reality gives credence to the theory of bounded reality that compels business organisations to try to embrace actions that mitigate the costs of operation by establishing an efficient governing system (p.3). For instance, a construction company that seeks profitability will need to be able to identify and engage

in a supply chain that is not long, to ensure that materials can be acquired within a shorter period and with minimum stakeholders. In another example, TCT is manifested when companies commit funds to information-seeking in trying to engage only suppliers who reflect environmentally friendly practices in the production process (Tate et al., 2011). In other words, TCT postulates that the fewer the stakeholders of a supply chain, the better its cost efficiency. In respect to this view, Salam and Khan (2018) argued that there is a need for the identification and embrace of supplier selection criteria that positively affects the quality of coordination and production costs within the institution.

Alternatively, TCT is also predicated on the element of opportunism which contends that human stakeholders in a business interaction always try to seek selfish interests which in turn renders the transaction costs higher than average. Based on such a tangent of understanding, the suppliers seek to realise more returns from the transactions they make with a company, while the company seeks to realise reduced costs (Goffin et al., 2006). According to Kanwal and Rajput (2016), opportunism and behaviour uncertainty may pose a significant challenge to the supply chain which demands the engagement of an efficient SCM framework to mitigate the costs. An elongated supply chain, in line with the dictates of TCT, would result in increased overall costs; that is, the bigger the number of stakeholders, the more extensive the opportunism and uncertain behaviour (Riedl et al., 2013). For example, a construction company needs to be able to involve suppliers that are ready to meet their demands at a mitigated cost.

Considering TCT and its assumptions, it can be agreed that the selection of a few suppliers that are competent and reliable is important. Thus, to select such suppliers in a pool of suppliers, multiple criteria are needed. Similarly, considering opportunism and change behaviour of the suppliers, it can be agreed that the cultural factors may play significant roles. Therefore, the current research employed TCT assumptions to deduce the most important criteria that enable the construction companies to assess and select the right suppliers so that these companies can be cost-efficient. Likewise, this research employed TCT to explain how cultural factors can influence the selection, especially how opportunism and change behaviour affect selection decision-making.

TCT is an important resource because it streamlines the assessment of cultural factors. Since the current research needs to analyse the influence of culture on the supplier selection process, it requires the identification of the optimal building blocks. Such a criterion can be achieved sustainably through the application of TCT, which is hierarchical in nature according to Kanwal and Rajput (2016). Generally, TCT is important because it identifies the areas of concern that need to be addressed in ensuring that the ultimate supply and procurement cost is mitigated to a level that can be easily addressed by the given company, as explained by Gedajlovic and Carney (2010). Notably, TCT is also crucial because it reinforces the application of relatable ethics in business transactions. Shadab (2012) explained that TCT provides a medium through which the ethical elements of ethics can be streamlined to reflect and meet the needs of both the supplier and the procuring company. Overall, TCT is an important addition to the analysis of cultural influences in the supplier selection process because it reflects the hierarchical importance of different cultural values and their implications on the structure or dynamic of the organisation.

2.2.2 Institutionalisation Theory

Institutionalisation theory can also be used to explain the nature of supply chains and their relevance in the overall productivity of the organisation. As a compelling framework, it highlights the importance of organisational environment, which influences the success and trajectory of organisational operations. According to Grewal and Dharwadkar (2002), institutional theory suggests that if the institutional values, culture, and beliefs are not aligned to realise efficiency, then the organisation would be less likely to experience rapid growth. This assumption is relevant to the assessment of the supplier. The assumption reinforces the feasibility of the link between the supply chain effectiveness and the managerial decisions that are integrated to drive the process. Subsequently, Seitanidi and Crane (2009) inferred a link between the values of the organisation and the CSR commitments that are reflected by the potential and interested suppliers. For instance, if the supply chain management of a company is inefficient, it is likely to result in the wrong selection of suppliers, which in turn leads to incurring unnecessary costs. Importantly, the institutionalisation theory further explains the commitment that is made by companies in seeking partners who reflect their environmentally inclined production actions (Everard et al., 2016). Institutionalisation

theory generally informs the appropriateness and relevance of the supplier in relation to the values within the organisation. Institutionalisation refers to the presence and integration of values that augment the quality of production and relationships. As an important theory, it enhances the organisation and efficiency of operations that are overseen within the subjective companies. In the supply framework, institutionalisation theory informs the area because it defines the motivations and impacts that may be generated from the engagement of partners (Koulikoff-Souviron & Harrison, 2008).

Reflecting on the criticality of the institutionalisation theory in driving sufficiency in internal factors, Tolbert and Zucker (1996) argued that an institution is defined by action. From this statement, the institutionalisation theory reflects upon the different combinations and collective actions that are geared towards the achievement of defined goals. Hansen (2001) also added that the institutionalisation theory assumes an isomorphous pattern of development, which reinforces the need for leaders and business stakeholders to engage in decisions that are in line with the prevailing market dynamics. The scholar stated that the theory seeks a more concerted effort by managers in ensuring that the inferred supply decisions are in line with the demands of the organisation and the overall business community.

Based on the above assumptions, institutionalisation theory is relevant to the current research. The theory underlines the intrinsic roles of the organisational and industry structure in informing the supply decision makers. As an important structural framework, institutional theory looks at both the practical in the production process and its link with the abstract (Roberts, 2012; Seitanidi and Crane, 2009). The theory posits that the goal of any organisation can be achieved when all necessary stakeholders are considered. It also posits that the decisions need to be well considered so that unsuitable parties will not join the organisation. For instance, if an organisation uses technology, institutionalisation theory facilitates the identification of the best areas of concern to be addressed and the most appropriate values to be integrated in achieving such a sustainable goal (Baptista et al., 2010). Thus, these assumptions try to ensure that the goals are achieved. These assumptions also seem to focus on the critical assessment of supplier selection. The assessment is about having proper selection criteria. Therefore, the current research employed the assumptions of the theory that

when relevant and crucial selection criteria are used, potential right suppliers may be selected.

2.2.3 Agency Theory

The agency theory can also be used to explain the supply chain management process and its influence in the establishment of the supplier selection criteria. As a relevant theoretical framework, this theory seeks to establish the nature of relationships between different stakeholders within an organisational institution. According to Zsidisin and Ellram (2003) the theory examines different challenges that tend to be manifested when a principal in an institution delegates its work to an agent (p. 16). These scholars also noted that the theory applies behaviour-based techniques to the mitigation of risks that are reflected in the supply chain process. Fayezi et al. (2012) added that agency theory is relevant to the SCM process in two ways. The authors stated the theory informs the development of inter- and intra-organisational relationships between the principal and the agent. The authors also stated that the theory seeks to define metrics that can be used to sustain relationships between suppliers and consumers during the entire production process.

According to Cousins et al. (2006), the agency theory is used to define contractual responses that are reflected by the agents or principal, as well as uncertainties around the relationship between the agents and their principal. Mainly, it addresses the cultural obligations and expectations that are extended towards different individuals in trying to ensure that they abide by the pre-established institutional frameworks of relationship (Shapiro, 2005). It looks at the freedoms and power that are allowed for each of the stakeholders and the alignment of their priorities to the overall institutional goal (Belzer and Swan, 2011). In a similar view, Simatupang and Sridharan (2002) explained that the theory proposes some criteria that could be used to understand and diagnose the relationship challenges that are reflected by supply chain actors. Their criteria include self-interest, risk aversion, lack of trust and misplaced policy implementation. Other than diagnosing the challenges, Heracleous and Lan (2012) added that the theory offers a framework through which the principal can holistically explore the potential causes of the impairments to relationships that may manifest between the management and suppliers. Meanwhile, these scholars noted that a major weakness in the theory of SCM is that it does not effectively capture the impact of other social

factors, as it leans more towards the economy. For example, the differences in attitudes and beliefs between the agent and principal are not considered in their relationship and, instead, the economic drivers provide the ultimate tool in the establishment of the feasibility of the relationship.

Corresponding to the above explanation of the scholars, it can be affirmed that SCM consists of different players with diverse interests. It can also be affirmed that the principal here is the buyers (the construction companies in this context) and the agents are the suppliers. It can be noted from the above explanation that it is necessary to identify a framework that supports the realisation of the collective goals without jeopardising the interests of the parties (i.e. principal and agents). Agency theory captures the fluidity of the values that tend to inform the supply chain management process (Zomorrodi and Fayezi, 2011). It can also be noted that economic factors are considered more in the theory than social factors. Therefore, this theory is relevant to synthesising different criteria for supplier selection. It will enable the determination of the crucial role that is played by value and order of production in sustaining relationships between the different stakeholders (Kim and Mahoney, 2005). The current research will contribute to the theory, as it focuses on the cultural factors of the multiple criteria for supplier selection.

2.3 Supplier Management

Supplier management refers to efforts and strategies that are embraced by leaders of organisations to facilitate material, information and capital flow between the suppliers and other relevant stakeholders to satisfy the needs or requirements of organisations' clients (Molamohamadi et al., 2013; Şen et al., 2008). In supplier management, the process goes beyond the identification of potentially feasible suppliers. It includes regulating suppliers' activities to ensure alignment of priorities, efficiency, and effectiveness. Accordingly, Konys (2019) expanded the meaning of the term supplier management to include the evaluation of supplier selection processes, as well as other areas of the organisational environment and culture that facilitate the sustenance of operations. Supplier management is an important area that ensures that the supplier selection method is in line with the prevailing structures. According to Narasimhan (1983), successful supplier selection reflects a common and demanding managerial problem and is an extension of conventional managerial challenges that are predicated

on trade-offs (p. 27). These scholars also added that the area ensures that suppliers are engaged in any activities that make the organisation realise its sustainable growth. These scholars concluded that supplier management is meant to ensure that operating costs are maintained at a sustainable level.

Supplier management also entails the identification of optimal resources that can be used to mitigate the risks related to the supplier chains. The various dynamics and considerations that inform the supply process may impede any linear approaches that are committed to achieving parity and sustainability. Thus, the scholars stated that supplier management is geared towards the prediction of the given challenges and the identification of optimal resources that could then be applied to achieve continuity in operations. In reflecting on the immensity of supplier management, Lee et al. (2001) contended that supplier management is crucial because it leverages information acquired during the supplier selection process to provide sustainable interventions that can be used to improve the quality of the existing supply chain. These authors pinpointed that supplier management defines the criteria that should be used in measuring the different facets of the organisation and the mitigation strategies concerning SCM.

In respect to the importance of supplier management, the rest of these subsections focus on supplier selection and the key selection criteria.

2.4 The Supplier Selection and the Key Criteria for Supplier Selection

According to Miller et al. (1981), supplier selection and SCM have been considered as a significant subject for many operational management studies. Moreover, in recent years, supplier selection has become a more serious issue because of the growth of knowledge sharing within the supply chain, according to Fine (2000), Kaplan and Sawhney (2000), Simchi-Levi et al. (2000) and Handfield & Nichols Jr. (1999). Furthermore, many managers have more recently become aware of the importance of suppliers to the organisation and their effects on the overall performance of the company (Choi and Hartley, 1996; Flynn et al., 1994; Gonzalez et al., 2004; Vonderembse & Tracey, 1999).

Supplier selection falls under strategic-level decisions, which include demand planning, strategic alliances, and outsourcing. In a study conducted by Yilmaz et al. (2011), it was concluded that in a supply chain, supplier selection is a serious strategic procedure that has direct effects on the quality of products. According to these authors, the main objectives of the supplier selection process are to select the right suppliers, who are suitable for a certain service or product. The authors noted that it is a decision that affects the overall performance of the company.

The importance attributed to the process requires that multiple criteria are used to select the right suppliers. A company in need of suppliers must look at the performance of each supplier over the years, their financial standing and the cost of supplying goods, among other factors. This makes the supplier selection process a multiple criteria decision-making problem (Beil, 2009, p. 2).

The competitive corporate environment experienced today means that certain dimensions, such as product delivery, the quality of the product, and the flexibility and cost of the operations, must be incorporated into the selection of suppliers. This competitive environment also compels businesses to consider the decision of selection of a supplier important for the success of their production management. The supplier evaluation and selection influence the long-term commitments and performance of a business. Purchasers of products need to assess each supplier carefully due to the varying strengths and weaknesses of each supplier (Yildiz & Yayla, 2015, p. 158).

Therefore, the selection of suppliers is an end-to-end process. The selection process and decision encompass many elements including quality, capacity, net prices, the history of performance, delivery, communication systems, financial capability, supplier relationship management, service, and geographic location (Dickson, 1966; Weber et al., 1991). In the selection of a supplier, the initial stage is usually the identification of the criteria to consider. A study carried out in the United States (USA) by Dickson (1966), with 273 purchasing managers, confirmed an average of 23 types of criteria. According to the study, the most commonly included criteria were delivery, facilities, warranty, production capability, performance history, initial price, claim policy and technical abilities.

Ellram (1990) applied a hierarchical strategy based on technology, financial position, organisational strategy, performance, and culture. A similar study highlighted the essential elements of supplier selection as delivery, cost, technology, standard, geographical location, facilities and capability (Weber et al., 1991). The process of supplier selection and evaluation is vital in any organisation, due to the dynamic nature of the supplier selection environment, and it is a core element of the SCM system. The field comprises core values that can be supported by collaboration, selection, and efficient use of information technology, which improves flexibility as well as a person's effectiveness (Bechtel & Jayaram, 1997). These studies showed that the key elements of the selection criteria for suppliers include the cost, quality, price and delivery performance (Wilson, 1994).

The relationship between the above-mentioned elements depends on the nature and form of the goods produced (Lehmann & O'Shaughnessy, 1982, p. 1974). According to Verma and Pullman (1998), determining whether a supplier selection criterion related to the intended importance in a purchaser's school of thought was mainly dictated by the quality of goods and services, though the value and performance might be the key selection factors. Choi and Hartley (1996) played an integral role in research in this field by examining the supplier selection of organisations at different stages. These scholars pointed out that developing selection criteria is an important process for any supply chain.

Furthermore, some research conducted by various scholars including Piercy et al. (1997), Katsikeas and Leonidou (1996), Thorelli and Glowacka (1995), and Min (1994) highlighted the significant issues such as the environment, the economic dynamics, and cultural conceptions in worldwide market purchases. With the environment, the supply chain in the current setting ought to reflect the environmental commitments that inform a given setting. This has conferred the impact of environmental factors on purchasing behaviour. Similarly, the economic dynamics allude to factors such as cost and economic systems that inform the structures of different markets. Lastly, cultural factors are a critical consideration because they define elements, such as values and beliefs, which influence the response that is extended by the principal and the agents in the supply chain (Deng & Wortzel, 1995).

Vonderembse and Tracey (1999) studied the procedure of supplier selection in manufacturing industries to establish the levels at which procurement administrators applied the knowledge of supplier selection and their criteria. The study also emphasised how tactics affected the working conditions of manufacturing firms. The study concluded that the supplier selection criteria were more widely applied than supplier involvement. Another study conducted by Youssef, Zairi & Mohanty (1996) explained that the supplier selection criteria were considered the most common problem in business by purchasing managers.

Mwikali and Kavale (2012, p. 190) stated that decision makers need to identify characteristics that will be used to assess suppliers to ensure that they are appropriate. These scholars recommended that suppliers are evaluated against certain characteristics to determine the best-suited supplier. Beikkhakhian et al. (2015, p. 6226) also argued that the organisational profile of suppliers is a key factor considered in the selection process. These scholars recommended that decision makers should look at the financial performance of the supplier, their achievements in sales and their technology strategy. Mwikali and Kavale (2012, p. 192) complemented this by noting that decision makers should consider their delivery schedule and response to the market. Similarly, these authors stated that easy communication between the organisation and the supplier is also a factor that affects the supplier selection process because it influences the long-term relationship.

The above factors, among others, are considered in the supplier selection process. It is worth noting that each organisation gives different weights to different factors, depending on what they are looking for in the supplier. This means that the selection criteria always differ, especially when the organisations operate in different industries or sectors. Although these factors mostly depend on what the company wants, the need to comply with the standards set in the respective industry also influences the decision-making process (Mwikali & Kavale, 2012, p. 192).

Amorim et al. (2016, p. 802) contend that the supplier selection process continues to evolve as more factors are introduced to the selection criteria. These scholars noted that the factors are affecting the decision-making process of supplier selection. These scholars also noted that today’s decision makers are required not only to consider the

business operations of a supplier, but also the environmental impact and social responsibilities of their operations.

In respect to the above scholars, the following criteria appear to be the most important factors that the companies commonly considered during their supplier selection process. They are discussed below:

(1) Cost and Price: cost is still considered to be the primary concern of buyers (Pal et al., 2013) and it is the most significant criteria in supplier selection (Cengiz et al., 2017). The selection criteria have been of academic interest since the 1960s. Although a few or even a single criterion has been used in the supplier selection process, there has been a focus on the cost (Rezaei et al., 2016). This could be the reason that companies regard supplier selection as, perhaps, the most important function for purchasing, due to material costs. Companies know that if they can save costs on their materials, they can be cost efficient in their operations (Chang et al., 2011). Cost is important not only because it is directly related to profit, but because it can increase competitiveness (Dargi et al., 2014). Hence, companies reduce their fixed costs to maintain competitiveness and stay in the market (Shahroudi & Tonekaboni, 2012).

Suppliers who can meet the needs of the companies at a comparatively low cost are most likely to be considered (Chang et al., 2011). Moreover, the cost is an important consideration when sourcing raw materials and components because they make up 70% of the total cost of a product (Shahanaghi & Yazdian, 2009; Shahroudi & Tonekaboni, 2012). This can be higher in high-technology companies, where services and materials can account for up to 80% of total costs (Pal et al., 2013) and it has even been reported that the raw materials can account for up to 90% (Rezaei et al., 2016).

One of the main goals of SCM is to reduce costs (Shahroudi & Tonekaboni, 2012) and the selection of the right supplier offers the opportunity to reduce costs in the supply chain (Pal et al., 2013). In terms of costs, the decision makers will be keen to look at the purchase price, taxes and transportation costs relating to each supplier. This is because each company aims to maintain low production costs as a way of maximising profits. The cost of the raw materials from each supplier must be assessed, together with other costs, such as labour costs and costs due to delay. The decision makers,

therefore, try to find the supply base with the lowest prices. Price, therefore, remains an important factor that affects the selection process (Roshandel et al., 2013).

In many companies, more than half of the cost of a product comes from raw materials. This means that companies are always looking for suppliers that can provide low-price and high-quality raw materials within the required time. As a result, the cost and price of the supply chain have become important points to consider (Jadidi et al., 2014). An important consideration regarding the cost and price is that buying in bulk can be a way of reducing costs (de Boer et al., 2001). Furthermore, receiving a quantity discount must be considered against the balance between minimising total purchasing costs and maximising the purchasing value (Hamdan & Cheaitou, 2017a).

The supplier selection problem, particularly quantity discounts in a situation of uncertain demand, has been addressed by Zhang and Chen (2013). They proposed a model that uses only costs for the supplier selection. The quantity discounts bring in other considerations, but Hamdan and Cheaitou (2017b) claimed that there is a lack of models that consider quantity discounts with green aspects.

Therefore, the cost and price are very important criteria for supplier selection. However, some scholars argued that the cost and price should not be the most important criterion. Mukherjee (2014) argued that the cost is only the main consideration when an organisation is a reactive buyer. This scholar argued further that the organisations that aim to be proactive in their buying should not consider a low cost as the only reasonable criterion to decide on the supplier. Zouggari and Benyoucef (2012) also stated that focusing on the cost and prices for the supplier selection, using mathematical modelling, fails to address subjective criteria. Thus, the current research regards the cost and prices as the key multiple criteria.

(2) Quality: the quality of materials and products is also a factor that affects the supplier selection process. Decision makers assess the extent to which a supplier can improve or maintain their quality and delivery performance. Maintaining the quality of supplies is important for a company to improve its position in the market (Beikkhakhian et al., 2015; Braglia & Petroni, 2000). Thus, Zimmer et al. (2016) stated that quality is the most important economic criterion, followed by price and flexibility. Beikkhakhian et al. (2015, p. 6228) supported this by noting that where a company contracts a

supplier with poor-quality products, such as raw materials, this reflects negatively on the final product of the company. This means that the product made by the company ends up being of poor quality. As a result, the company loses business due to consumers' lack of confidence in their products. Thus, companies need to consider whether the culture of each supplier is based on quality. Overall, suppliers have an important influence on a manufacturer's performance through constant improvement in quality. Sarkis and Dhavale (2015) also added that inferior quality has a direct impact on the purchaser's financial position.

According to Asadabadi (2017), the satisfaction of the customer very much depends on the quality of the final product and service. This scholar also stated that the quality of the products is very much dependent on the quality of the raw materials. Hence, Fallahpour et al. (2017) supported the assertion that assessment of the impact of raw material quality on the final product and service is, therefore, an important consideration. The scholar said that the materials should meet and even exceed the buyer's expectations. Meanwhile, Asadabadi (2017) remarked that using buyers' needs in the supplier selection should be done with caution because those needs may change over time. Goren (2018) explained further that the purchase decision makers need to adjust their priorities according to the changes in their final customers' needs. The author also advised that it is important to note that the quality of raw materials is very difficult to determine until the final product and service are made.

Fallahpour et al. (2017) outlined specific considerations of quality. These scholars stated that the rejection rate of products, the ability to handle abnormal quality, and processes for the internal quality audit of materials are specific considerations. These scholars also stated that the rejection rate is the number of supplied goods that have been rejected by quality control. The scholars noted that a higher rejection rate leads to a lower rating of the supplier during selection. The scholars explained that the ability to handle abnormal quality is considered as an advantage of the supplier because it is positively associated with an increase in the satisfaction with the supplier. The scholars also explained that auditing is a way of ensuring a maximum level of quality for each supplier.

Considering the above arguments and explanations of quality as a selection criterion, it can be agreed that quality plays important roles. It a well-established fact that quality

is important in the construction industry. For instance, poorly built houses can lead to deaths (of people). Therefore, this criterion is included in the multiple selection criteria of the current research. Meanwhile, it is important to note that this criterion is difficult to ascertain in some materials of the construction industry.

(3) Delivery and Order Fulfilment: delivery is considered almost as important as cost, and it has been found that delivery reliability has a significant positive effect on customer satisfaction and customer performance (Tracey & Tan, 2001). Similarly, Dey et al. (2015) found that reliability of order fulfilment was second only to quality. Černá and Buková (2016) stated that the choice of supplier has an impact on a company's ability to respond effectively. The authors noted that delays from the supplier can lead to dissatisfaction of the final customer. Wu et al. (2016) added that the rate of processing orders reflects the supplier's management ability and the desire to cooperate. Tsai et al. (2012) and Van Der Rhee et al. (2009) pinpointed that the flexibility of the supplier in adjusting demands according to the requirements is part of the delivery capability of such a supplier. In support of this idea, Černá and Buková (2016) presented a methodology for supplier selection of a logistics company. These scholars included reliability, compliance with deadlines, delivery time and responsibility as the most important criteria. They stated that reliability must be included because it deals with the order amount, quality and time.

It can be agreed that the above scholars have highlighted the essence of delivery and order fulfilment in supplier selection. It can also be noted that these criteria are very close to previous criteria. Thus, it can be argued that these criteria and the aforementioned ones are among the key selection criteria for suppliers.

(4) Experience / Past Performance: Past performance is among one of the most important selection criteria. Past delivery performance is equally important as other selection criteria such as price and quality. Therefore, performance is a criterion that encompasses other criteria such as quality and cost (Chen, 2011). For example, Chen (2011) looked at the description of performance indicators and these include the return rate of finished products concerning the quality and quantity discounts in relation to cost. Shahanaghi and Yazdian (2009) stated that performance history includes technical ability, price, and financial position. Similarly, Tsai et al. (2012) added that

management ability, domain knowledge, and implementation experience are part of the technical support and experience of the supplier.

With the arguments and examples of the above scholars, it seems important to consider the experience and past performance of the suppliers when selecting them. Meanwhile, it is worth noting that the experience and past performance do not necessarily have to be with current decision makers. It is only important for decision makers to check the experience or records of the suppliers. Nonetheless, the current research considers this criterion.

(5) Financial Position: Muralidharan et al. (2002) included the financial condition of a supplier as one of the main selection criteria for supplier selection. Wood (2016) reiterated this assertion by stating that macroeconomic factors and the complex nature of markets make the financial position an important criterion. This scholar noted that the criterion influences the performance of the supplier. Min (1994) said that even though there might be cost savings or other benefits of a supplier, if the supplier does not have a good financial situation, its relationship with the buying organisation may gradually decline. The scholar stated that this is more likely to happen in developing countries where only a few suppliers are supported by governments through subsidies.

The financial position could include financial success and financial reliability (Lienland et al., 2013) and it is the most important qualitative attribute of a supplier (Ulutas et al., 2016). Tsai et al. (2012) introduced a balanced scorecard method that uses financial and non-financial measures – the financial measures are a way of calculating the fiscal influences of activities. The main argument of these scholars is that such measures ensure the proper selection of the right suppliers.

Accordingly, it can be agreed that the financial position of the supplier needs to be a crucial criterion in selecting the right suppliers. Therefore, this current research regards it as one of the important supplier selection criteria.

(6) Green Practices: companies are engaging in activities that provide opportunities to transfer and exchange knowledge on green practices, such as green purchasing. Companies have also undertaken to transfer knowledge from employees with green knowledge to suppliers who have incorporated green practices. The

companies undertake this step purposely to ensure that they also incorporate green practices into their operations. In fact, some companies have also undertaken to offer training to their suppliers on environmental issues to ensure that these issues are considered in their operations (Awasthi & Kannan, 2016).

The environmental performance of suppliers is an important factor in achieving a green and sustainable supply chain. Today's companies are faced with the challenge of ensuring that their economic growth does not contribute to the pollution or degradation of the environment. Pressures are arising from government and other regulatory agencies requiring companies in the supply chain to ensure that their practices do not pollute the environment (Igarashi et al., 2015). There are also pressures from the fact that customers are now aware of the need to purchase green products and services. This means that companies in the supply chain today need to manage their environmental burdens to ensure that they are competitive. In intra-organisational operations, the companies focus on factors such as greening production, transportation, and storage operations (Igarashi et al., 2013). In supporting these efforts, company managers have realised that it is important to also focus on inter-organisational operations by focusing on the performance of suppliers. Thus, companies have introduced new criteria to evaluate suppliers. Other than price, cost, and quality, which historically have been the dominant factors, energy efficiency, carbon emissions, recycling initiatives, and water usage are other factors that have now been introduced. In fact, companies now utilise multi-criteria decision-making tools to select suppliers who have met the requisite environmental criteria (Banaeian et al., 2016).

The need for companies to gain a competitive advantage in the market has contributed to the incorporation of green and sustainable supply chains. Companies in the supply chain always pursue activities that ensure that they gain a competitive advantage. Because customers have warmed up to the greener practices, companies must ensure that they adopt these practices if they are to maintain or gain more presence in the market. Greener practices, such as eco-design and green marketing, are some of the factors that are evaluated when evaluating and selecting suppliers (Trapp & Sarkis, 2016).

The inclusion of environmental criteria in the selection of suppliers has brought complications to the decision-making process for the buying companies. The inclusion of green practices tends to increase costs. Meanwhile, the companies must ensure that they choose the right suppliers that provide materials at a low cost and with high quality. Similarly, the companies must ensure compliance, especially with legislative standards. Thus, the supplier selection process becomes problematic (Chai & Ngai, 2015).

Although green practices have a positive impact on society, using this as a criterion for supplier selection has a financial impact and pressure on the companies. Meanwhile, this criterion appears to be very important as the world has agreed to combat climate change. Likewise, the construction industry is one of the sectors that needs to combat climate change. Similarly, as the current research aims to provide the key supplier selection criteria for modern construction companies, this criterion is considered.

(7) Sustainability: based on a review of 221 papers about supplier selection, Wetzstein et al. (2016) reported that sustainability is increasingly becoming an important consideration. Luthra et al. (2017) also acknowledged the need for sustainability criteria in the supplier selection and they cited customer knowledge and ecological pressure from the market and stakeholders as reasons behind this. Amindoust et al. (2012) said that there has been an increase in the growth of knowledge about sustainability, and sustainable supplier selection is crucial to achieving a sustainable supply chain.

Amindoust et al. (2012) also said that traditional supplier selection has often been economic based; however, with the changing of customer demands, the environmental and social aspects are now considered. This idea is confirmed by Mani et al. (2014), who said that pressure from social organisations about social and environmental issues has caused organisations to reconsider sustainable practices. Azadnia et al. (2012) stated that in addition to the market pressure, public awareness and government regulation make sustainability important. Reuter et al. (2012) claimed that stakeholders have made sustainability one of the central points of consideration in corporate strategy.

Sustainability includes economic, social and environmental considerations (Song et al., 2017). Although environmental sustainability is addressed separately, economic sustainability is also environmental sustainability, because it may include environmentally friendly packaging and costs associated with waste disposal (Grover et al., 2016). Thus, sustainability must be considered throughout the supply chain. Trapp and Sarkis (2016) highlighted that social, economic and environmental sustainability requires consideration of SCM. Ghadimi and Heavey (2014) also added that sustainability can be attained only if it is included in all areas of the supply chain. The scholars noted that this is the case when the demand for sustainable products requires sustainable components. This point is supported by Grover et al. (2016), regarding economic sustainability, that the costs in the supply chain need to be well considered if sustainability were to be achieved. The scholars included ordering and logistical costs, inventory costs and insurance costs among the possible costs to be considered under sustainability. Other factors outlined by these scholars, for consideration under economic sustainability, are rejection rate, quality, and Lean Six Sigma belts.

Furthermore, Grover et al. (2016) acknowledged that sustainable supplier selection is challenging, and they said that it is based on environmental and social issues that have not been addressed in traditional supplier selection. In response to this issue, the scholars included sustainability criteria as supplier selection criteria. They referred to this as Supplier Supply Chain Management (SSCM). Song et al. (2017) affirmed the proposition of SSCM by stating that companies maximise their profitability as they maximise their social well-being. These authors pinpointed that sustainable supplier selection is perhaps the most important aspect of SSCM and is directly linked to supply chain performance.

In the construction industry, supplier decisions have historically been based on matching equipment needs with the task that has to be completed. These decisions were based on cost, productivity, and capacity. However, with the advent of sustainability considerations, there is now an emphasis on the environment, efficiency, energy conservation, and the well-being of people and the economy (Waris et al., 2014). Waris et al. (2014) proposed that a selection criterion based on the concept of sustainability is needed for the construction industry. The authors recommended that

the *triple bottom line* of sustainability can be used by construction managers to appraise the selection of construction equipment suppliers. The triple bottom line seeks to ensure that companies are concerned with the environment as much as they are concerned with the generation of profits to sustain the business (Norman & MacDonald, 2004). It is premised on the ideals of CSR.

Several different models and methodologies have been proposed for sustainable supplier selection. Fallahpour et al. (2017) developed a model to identify the most important sustainable criteria in supplier selection, and found that economic sustainability is the most important, followed by environmental and social sustainability. Similarly, Nadoushani et al. (2017) presented a methodology for sustainable supplier selection that considers social, economic and environmental sustainability criteria, and Amindoust et al. (2012) considered economic, environmental and social criteria and sub-criteria. Luthra et al. (2017) also proposed a model for sustainable supplier selection and the application of the model revealed that the most important selection criteria for sustainability are quality, price, environmental costs, environmental competence, and occupational health and safety.

Goebel et al. (2012) offered guidance for purchasing, through the identification of elements of purchasing behaviour, and emphasised that environmental and social sustainability is very important. Song et al. (2017) proposed a framework based on the pairwise comparison, rough set theory, and a decision-making trial and evaluation laboratory (DEMATEL). The application of their model revealed that managers do not always give the required time and effort in determining the importance of different supplier selection criteria. Meanwhile, the authors noted that managers do focus on giving a supplier score that is reflective of sustainability criteria. Also, Amindoust et al. (2012) noted that the opinions of the decision makers and their preferences for suppliers are considered as subjective linguistic input for sustainable supplier selection, because the decision makers are managed using fuzzy logic.

The above explanations and models of the sustainability criterion show that it is one of the key criteria for selecting qualified suppliers. The above explanations also show that all aspects of sustainability – economic, environment and social – need to be considered when selecting suppliers. Similarly, the above models show that the criterion is well studied and is one of the interest areas of academics. Moreover, the

above explanations reveal that the criterion has an impact on other criteria, such as cost and price, and quality. Therefore, this criterion is considered in the current research.

(8) **Corporate Social Responsibility (CSR)**: the emergence of the concept of a sustainable supply chain has led to the inclusion of environmental, social and economic characteristics of suppliers in the selection process. The SSCM requires that different dimensions need to be incorporated. Companies are increasingly setting a requirement that suppliers should ensure that they engage in sustainable practices (Al-Tamimi & Hussein, 2014; Sarkis & Dhavale, 2015). One of the practices that has been incorporated into the supply chain is corporate social responsibility (CSR). This practice is where companies and suppliers are required to ensure that they engage in activities that confer public interest (Sarkis and Dhavale, 2015). The companies are, therefore, looking for suppliers who are not only engaging in sustainable practices but can maintain these practices for a long time (Orji & Wei, 2015). A similar contention is reflected by Tate et al. (2011) who revealed that one of the key concerns that informs decisions by companies in the supplier selection process is suppliers' commitment to the preservation of the environment around them. The scholars stated that the easier it is to access information around the suppliers' CSR record, the less costly the supplier selection process becomes, and hence, this leads to a reduction in the overall transaction cost which is beneficial to companies in the long run. Equally, Adebanjo et al. (2013) embraced the institutional theory in revealing that companies are increasingly committing resources to the screening of suppliers' CSR history because of the influence that the engagement of the overall supplier has on the intended clients and the host market state agencies. The decision is further prompted by buying firm practices that are conventionally leaning towards the acquisition of environmentally sensitive practices and those that are ethically aligned to avoid fraudulent practices (Hemmert et al., 2016). Organisations that practice CSR reflect certain values that must be reflected by the supplier for the relationship to be fruitful both economically and socially (Whitfield & Landeros, 2006). With the importance of CSR, it can be agreed that the criterion is important for evaluating and selecting the suppliers. The arguments of the above scholars support the criterion to be one of the key multiple criteria of supplier selection. Thus, this research is considered here.

(9) Ethics: supplier behaviour or ethics is also a major concern in the supplier selection process. A company seeking to contract a supplier needs to ensure that suppliers do not engage in unethical behaviour that could taint the name and reputation of the company (Moghaddam, 2015). Today, the unethical behaviour of suppliers in the supply chain has become a source of concern for many industries. Unethical behaviour includes unsafe processes, unsafe working conditions for workers and the use of child labour. Even when suppliers ensure that the cost of raw materials is low, unethical practices can lead to loss of value for the company when customers shun the company's products that are associated with the unethical suppliers (Chen & Baddam, 2015). Goebel et al. (2012) examined the influence of what they term 'ethical culture' on supplier selection with regard to sustainable resourcing; they found that the activity of the supplier becomes a way of protecting a company from being accused of unethical behaviour.

Due to increasing levels of globalisation, there has been an increase in outsourcing globally. Likewise, because stakeholders place increasing ethical demands on companies, the companies can be held responsible for the actions of their suppliers (Goebel et al., 2012). Chen and Baddam (2015) found that customers might buy products and services from companies with unethical practices, but these customers punish them by demanding lower prices. These authors also found that among companies that maintain ethical conduct, customers are ready to pay premium prices for their products and services, thus, giving them a competitive edge over others. This means that companies must ensure that they have ethical suppliers.

Other than the pressure from customers, government standards have also placed pressure on companies to ensure that they include supplier ethics as a criterion in supplier evaluation and selection (Chen & Baddam, 2015). Even when long-term contracts have already been made between the company and an unethical supplier, contractual control enables the company to demand that the supplier ensures that their practices and activities are in line with the standards set by the government (Xie et al., 2016). Contractual control regulates the behaviour of the supplier through agreements and clauses where the responsibilities of each of the parties are stipulated. The fact that the punishment for breaches is well stipulated in the agreements means that the company can ensure that suppliers are ethical in their conduct (Xie et al., 2016, p. 3).

Different factors may affect suppliers' ethics. In the selection process, the method used by a company to select a supplier determines whether or not the company is in a position to consider the ethics of the supplier. Mostly, the buying company can evaluate suppliers through public selection and social relationships. Public selection is where the company collects and uses open information, such as the mass media, social media, news and government records. The company then proceeds to compare the suppliers to determine which one is best suited to supply the materials needed (Heidarzade et al., 2016). One of the advantages of this method is the fact that it enables companies to evaluate and select a supplier from a wide pool of suppliers. This means that in such a situation, the company can evaluate the ethics of all the suppliers and compare them to determine the supplier that is best suited to their operations (Xie et al., 2016).

It is not only external stakeholders who exert pressure on the companies to be ethical; internal stakeholders do this too (Kleindorfer et al., 2005). Similarly, Goebel et al. (2012) suggested that companies should have an ethical culture that impacts how their management considers social and environmental criteria when making purchase decisions.

Although there is mounting pressure on companies to transact with ethical suppliers, companies continue to enter into contracts with the unethical suppliers. This situation is activated because companies give priority to low-cost materials, lead time and efficiency of suppliers, while giving less priority to the supplier's ethics. This may discourage the use of ethical suppliers with high costs. It may be difficult for companies to consider ethical suppliers if they have a long-time relationship with low-cost suppliers that make their operations efficient, even if the companies know that these suppliers engage in unethical conduct. This is because companies are more concerned about the economic gains of their arrangement. Nevertheless, the current research proposes that once decision makers have laid down all the necessary factors to be considered in the selection of a supplier, it becomes easier for them to give weight to ethical conduct, even if there is an existing relationship between the suppliers and the company. Therefore, this criterion is considered in the current research.

(10) Innovation: the selection of a supplier is also determined by the ability of the supplier to innovate and keep up with the latest technology. Companies are interested

in adopting technology or other measures that can ensure that production costs remain low while quality is maintained (Mwikali & Kavale, 2012). This is meant to ensure that such a firm maintains its competitiveness in the market. To achieve this, companies must always look for suppliers who are keen on innovating to ensure the low cost of products, transportation, and other operations. Innovation is also a critical tool because it provides a framework through which organisations can augment their supplier ties. In reflecting on the influence of innovation in defining supplier choices vis-à-vis innovation, Yan et al. (2020) indicated that companies prefer to engage suppliers who have a history of engaging innovative institutions.

To sum up this subsection, one of the objectives of the current research is to determine multiple criteria for the selection of suppliers via a mathematical model. It also compares the cultural influences that define supplier selection process in the UK and UAE. The current research, unlike previous research, demonstrates that it is essential for construction companies (in particular) to have a list of criteria for the evaluation and selection of their suppliers. One of the reasons for this need is that the higher the number of potential suppliers, the greater the need for the company to select the best supplier. This is because once the selection is made, the decision makers will have ensured that the selected suppliers meet the stipulated requirements. Thus, scholars including Thompson (1990), Pan (1989), Turner (1988), and Timmerman (1986a) applied different techniques including weighted average and mathematical programming for multiple criteria. Meanwhile, these models are not relevant to the modern business environment. The next subsection discusses different models and proposes a model that is used in the current research.

2.5 The Supplier Selection Criteria Models

Several qualitative and quantitative factors inspire varieties in the criteria employed in the supplier selection decision (Özfirat et al., 2014). According to Thakur and Anbanandam (2015), the process of supplier selection can be described as a multi-attribute decision-making (MADM) concept. As mentioned previously, Dickson (1966) was one of the first researchers on the topic of the criteria of supplier selection decision-making; he developed a model for selection criteria that included 23 different criteria (Figure 2.2).

Rank	Factor	Mean Rating	Evolution
1.	Quality	3.508	Extreme importance
2.	Delivery	3.417	
3.	Performance History	2.998	
4.	Warranties and Claim Policies	2.849	
5.	Productions Facilities and Capacity	2.775	Considerable importance
6.	Price	2.758	
7.	Technical Capability	2.545	
8.	Financial Position	2.514	
9.	Procedural Compliance	2.488	
10.	Communication System	2.426	
11.	Reputation and Position in Industry	2.412	
12.	Desire for Business	2.256	
13.	Management and Organization	2.216	
14.	Operating Controls	2.211	Average importance
15.	Repair Services	2.187	
16.	Attitude	2.120	
17.	Impression	2.054	
18.	Packaging Ability	2.009	
19.	Labor Relation Record	2.003	
20.	Geographical Location	1.872	
21.	Amount of Past Business	1.597	
22.	Training Aids	1.537	
23.	Reciprocal Arrangements	0.610	Slight importance

Figure 2.2 Dickson's Supplier Selection Criteria (Dickson, 1966)

Figure 2.2 shows that the quality criterion led the list. The figure also shows that the delivery, performance history and price are important criteria. This implies that the aforementioned criteria (in the previous subsection) are historically confirmed. In Figure 2.2, some criteria such as ethics, sustainability, and innovation are not presented. The possible reason for this is that Figure 2.2 was developed when the economic situation was not developed as it is now. The current business environment is global and the advent of information and communication technologies (ICT) has changed the business operations as compared with the 1960s.

Carter (1995) proposed a new model that included new selection criteria. This model is called the seven Cs of supplier evaluation model. The criteria presented in the model are competency, capacity, commitment, control, cash, cost, and consistency. It is

noteworthy that Carter's model is one of the core theories in the field of supplier selection. However, its initial version did not reflect the gradual evolution of the supplier selection criteria. Subsequently, Carter (2005) amended the model with three new criteria: culture, clean and communications. The new model is called the 10 Cs of supplier evaluation (Carter, 2005). This model incorporated the cultural factor for the first time in a supplier selection model. The author perceived that the supplier must be treated in the same way as the consumer and advised that both must have some common values and practices which must be considered in the supplier selection decision-making.

In 2009, a new model was developed by Rogers (2009). The criteria model is called the SOCCER supplier evaluation model. This model consists of six main factors and 30 sub-selection criteria. It is shown in Figure 2.3 The model presented more significant selection criteria that had not been covered before in supplier selection models. It is worth saying that the model is very comprehensive and effective.

S Strategic Direction	**O** Operational Capability	**C** Customer Approach	**C** Cost Structure	**E** Economic Performance	**R** Research & Development
• Management Approach • Business Structure • Corporate Strategy • Corporate Governance • Management Team	• Product Quality • Human Resources • Admin Systems • Logistical Capability • Information Technology	• Key Customer • Market Position • Customer Relations • Commercial Approach • External Relations	• Wage Base • Overhead Costs • Supply Base Cost • Product Cost • Delivery Cost	• Profit Level • Profit Centers • Financial Structure • Risk Exposure • Cash Flow	• Core Competency • Research Capability • Process Scale-Up • Project Management • Intellectual Property

Figure 2.3 The SOCCER Supplier Evaluation Model (Rogers, 2009)

In 2011, research was conducted by Monczka et al. (2011). A list of supplier selection criteria was developed from the research. This list consists of 15 important criteria: cost and price, quality and delivery, total quality performance, cost structure, process and technology capability, sustainability and environmental compliance, production scheduling and control systems, long-term relationship potential, financial stability, employee capabilities, management capability, system and philosophy, e-commerce capability, policies and techniques, and supplier's sourcing strategies. The scholars did not rank these criteria. It is assumed that they left the users of their model to rank the importance of the criteria according to their area of interest and requirements. Such

an interpretation is more flexible, as it recognises the dynamic nature of organisations and their interests in pursuing suppliers.

In 2012, another study was conducted by Lysons and Farrington (2012). The study stated that 10 main criteria must be involved in supplier selection decision-making. These criteria are insurance, quality, finance, productive capacity and facilities, environmental management, organisational structure, existing contracts held and performance, health and safety, SCM, and sub-contracting and procurement capability.

Moreover, Thakur and Anbanandam (2015) reviewed research that focused on supplier selection criteria from 1966 to 2015. According to their research, quality, cost/price, delivery, and reliability were the most used criteria in previous studies. It is shown in Figure 2.4.

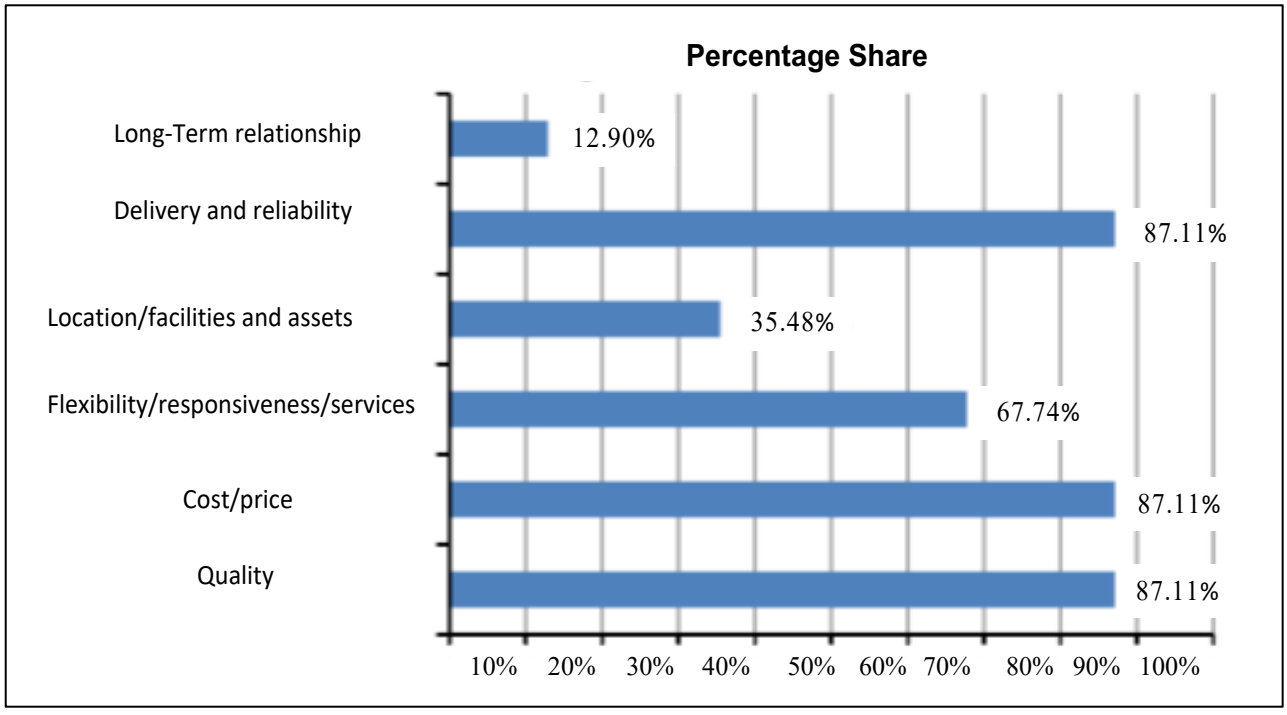


Figure 2.4 The Percentage of Supplier Selection Criteria Used in Studies from 1966 to 2015 (Thakur and Anbanandam, 2015)

The above Figure 2.4 confirms that the quality, cost and price, and delivery and reliability are key criteria, as explained in this section. Meanwhile, Benton (2010) noted that supplier selection has two types of evaluation. The first type is based on an assessment of the actual production or service process of the supplier and is called

process-based evaluation. Such an assessment can be done by site visits and supplier auditing. The other type of evaluation is performance-based evaluation, which is an investigation of the actual performance of the supplier, based on different selection criteria, for example, cost and price, quality, and reliability. This second evaluation type is used for the current research.

2.6 Cultural Factors in Supplier Selection

The evaluation and selection of suppliers in companies and industries is done by procurement managers who, in many cases, originate from various cultures. These managers may at times perform their duties alone and at other times work as members of a cross-functional sourcing team. The difference in the cultural backgrounds of the people involved in the selection process raises the question of whether such people are influenced by their culture, and if so, whether this also affects the selection decision. Research has shown that decision makers in the supplier selection process, who come from different national cultures, do not reason in a similar way or make similar business decisions (Carter et al., 2010).

Decision makers from western nations, such as those in Europe and America, and those from eastern nations, such as China, Japan and Korea, have continued to maintain different thought systems for a long time. Cultures that originate from various levels of development, either at the national or organisational level, differ in their decision-making. National cultures affect the decision-making process of the people involved in the supplier selection process. Research has shown that eastern decision makers have a different approach regarding labour costs to western decision makers. Eastern decision makers look at low costs because the procurement environment in these countries is moving towards low costs. Western decision makers are not as concerned about labour costs as eastern managers (Carter et al., 2010).

Min (1994), in consideration of the implications of a globalised world, highlighted that decision makers may be unfamiliar with foreign suppliers, therefore include the consideration of culture in their selection criteria. However, the author clarified that culture here is perceived as a negative attribute because it is perceived as being a barrier to communication. The author added that the specific factors of culture include language, ethics, business customs and means of communication. The author noted

that potentially, such differences between cultures can cause issues between buyers and suppliers.

There are some different factors related to suppliers that are considered by buying companies. The difference in organisational culture between a buyer and a supplier has been shown to have a significant influence on supply chain performance. Chu and Spires (2008) investigated the cross-cultural differences and found that there were differences concerning the benefits of cost and benefits of different decision strategies. Cadden et al. (2013) investigated the fit between organisational cultures in this regard and found that complementarity in cultures was more likely to lead to successful outcomes in supply chain performance. These scholars noted that the organisations with high-performing supply chains were significantly different in their organisational cultures and those with low-performing supply chains were shown to have almost identical profiles with their organisation in their study.

Similarly, with regard to the alignment between the purchaser's needs and supplier's capabilities, there should be consideration of the extent to which the supplier's business culture is complemented by the business culture of the buyer (Petersen et al., 2005). These scholars stressed that there is a need to choose a supplier that has the right organisational culture. The scholars stated that they found in their study that the right organisational culture has a positive effect on the decision-making of the project team during a new product development process. The scholars also noted that it is not just the supplier's qualities and capabilities that should be considered, but also the compatibility of the supplier's culture with that of the buying organisation.

Furthermore, Belassi et al. (2017) investigated the organisational cultural characteristics that affect the success of the buyer–supplier relationship. These scholars found that the organisations that have an open organisational culture, and are results oriented and long-term oriented are better at forming cooperative relationships. Liu et al. (2010) stated that there is a relationship between organisational culture and aspects of the institutional environment. These authors found that institutional pressures had a strong influence on the decision to use internet-enabled supply chain management systems and that this relationship was mediated by organisational culture in several different ways.

Besides, different cultures have been shown to affect the advantages that a purchaser will realise from choosing socially responsible suppliers. Thornton et al. (2013) investigated the extent to which the selection of socially responsible suppliers was associated with the buyer's financial performance across different cultures including the USA, China, and the United Arab Emirates. The study found that while those buyers who selected socially responsible suppliers enjoyed the better financial performance, the study revealed differential outcomes of socially responsible supplier selection (SRSS) between the different regions.

Culture could be a contributory factor in the trust relationship between a supplier and a manufacturer. It is important to consider the role of culture in investigating supplier–manufacturer relationships (Handfield and Bechtel, 2002).

The cultural context within which companies operate influences the buyer–supplier relationship. In reference to a particular cultural context, trust in local suppliers is negatively affected by high regulatory uncertainty, as has been shown in China (Wang et al., 2016). This was found to be more the case in domestic buyer–supplier relationships than in international relationships.

More broadly, the institutional environment has been shown to have a significant effect on information integration and trust in the relationship between buyers and suppliers in China. The institutional aspects of the environment include government support, legal protection and 'guanxi' (interpersonal relationships) (Cai et al., 2010). The institutional actors also include the organisation itself, other participants, and government and semi-government entities. Meanwhile, multinational organisations can evolve from being foreign investors to participating in the institutional environment and becoming strategic insiders (Wu & Jia, 2018).

Differences in institutional environments occur when multinational companies build end-to-end supply chains. They occur also where these organisations encounter an institutional environment that is different from their own in terms of regulation and normative and cognitive characteristics (Wu & Jia, 2018). The effect that the institutional environment has on the relationship between the buyer and supplier has been demonstrated by Wang et al. (2016), who found that this environment moderated

the relationship between trust and supplier opportunism in international relationships entered into by Chinese companies.

Many different cultural dimensions are used to differentiate between different cultural settings. One such framework for these cultural dimensions is the Globe Leadership and Organisational Behaviour Effectiveness (GLOBE) framework, which contains nine cultural dimensions, namely, performance orientation, assertiveness orientation, future orientation, humane orientation, institutional collectivism, family collectivism, gender egalitarianism, power distance, and uncertainty avoidance (House, 2004; Thornton et al., 2013).

With respect to the above discussions on culture, it is established that the evaluation and selection of suppliers in companies and industries is mostly done by procurement managers. These managers, in many cases, are informed by different cultural backgrounds. These managers may at times perform their duties alone and at other times work as members of a cross-functional sourcing team. The difference in the cultural backgrounds of the people involved in the selection process raises the question of whether such people are influenced by their culture, and if so, whether this also affects their selection decisions. Research has shown that decision makers in the supplier selection process who come from different national cultures do not reason in a similar way or make similar business decisions (Carter et al., 2010). For example, the decision makers from western nations, such as those in Europe and America, and those from eastern nations, such as China, Japan and Korea, have continued to maintain different thought systems for a long time. Cultures that originate from various levels of development, either at the national or organisational level, differ in their decision-making. National cultures affect the decision-making process of the people involved in the supplier selection process. Hence, the research has shown that eastern decision makers have a different approach regarding labour costs to western decision makers (Molamohamadi et al., 2013). The eastern decision makers look at low costs because the procurement environment in these countries is moving towards low costs, while the western decision makers are not as concerned about labour costs as eastern managers (Carter et al., 2010).

In their contribution, Willner et al. (2015) stated that the cultural dimensions of individualism and collectivism can highlight the differences in career decision-making.

These scholars explained that individuals with different cultural backgrounds differ in their decision-making. The scholars also explained that the individualistic cultural dimension is common to people from the USA and other western countries, while the collectivism dimension is common among Chinese people. Thus, the scholars stated that this difference has an impact on purchasing decision-making as well as the process of supplier selection.

Thus, Min (1994) included culture as part of the Analytic Hierarchy Process (AHP) framework. The author has associated it with communication as one of the sub-criteria; they regard it as 'cultural similarity'. Morano, Locurcio & Tajani (2016) described the AHP framework as a method that compares and defines various alternatives that may be applied in developing supply selection criteria with cultural considerations. Meanwhile, Becker and El-Said (2013, p. 91) noted that there has been an identified desire to purchase domestically as a result of the influence of patriotism. These scholars speculated that a significant reduction in cost could influence this decision. Rose et al. (2009) also stated that patriotism and political links are attributes of suppliers that are considered by purchasers, especially when the suppliers consist of powerful political personalities. Furthermore, Livanis et al. (2016) added that a supplier may also be influenced by the cultural attributes of the supplier's host country.

From the above scholarly discussion on cultural factors, it can be agreed that culture influences the decision-making. It has an impact on the inter-organisational relationship. Contextually, it has an impact on the organisation's national and international purchasing behaviour. Considering the construction industry, it can be agreed that companies may be influenced by their culture. Therefore, the current research adds cultural factors into the multiple selection criteria for suppliers in the construction industry (using the UK and UAE as case studies).

2.7 The Supplier Selection Decision-making Models

There are many methods available in the literature for supplier selection decision-making. Each supplier selection is unique; thus, there is no fixed method for every selection. However, scholars such as Sonmez (2006), De Boer et al. (2001) and Nydick and Hill (1992) assumed that it would be good to have a method or combination of methods that can be used for all needs of decision makers in supplier selection. These

scholars assumed that such a method would improve their decision-making process. They noted there are drawbacks to some of the available methods; thus, they stated that it may be difficult to choose the correct method to be used for a specific situation.

Nevertheless, several studies have been devoted to examining different supplier selection methods. De Boer et al. (2001) stated that several studies affirmed that supplier selection is complex. These scholars also stated that supplier selection requires multi-criteria decision-making. Thus, Sonmez (2006) examined different supplier selection decision-making methods. This scholar grouped the methods into different categories. The grouping is presented in the following Table 2.1.

Table 2.1 Decision-making Methods and Tools for Supplier Selection (Adopted from Sonmez, 2006)

	Category	**Method**
1	Artificial intelligence & expert systems	Neural networks (NN) Case-based reasoning (CBR)
2	Mathematical programming (MP)	Total cost-based approaches Non-linear programming Mixed-integer programming Linear programming (LP) Integer programming Goal programming Data envelopment analysis (DEA)
3	MCDM	AHP Outranking methods Linear weighted point Categorical method Multi-attribute utility theory (MAUT) Judgemental modelling Interpretive structural modelling Fuzzy sets
4	Multivariate statistical analysis	Structural equation modelling Principal component analysis (PCA) Factor analysis Cluster analysis (CA)
5	Other decision-making tools	Group decision-making Multiple methods

From the above Table 2.1, it can be noted that multi-criteria decision-making (MCDM) has many models. Sonmez (2006) also noted that MCDM is widely used in different industries for final supplier selection decision-making. This scholar also stated that the AHP model of MCDM is one of the most commonly used models. AHP was proposed by Saaty (1980). Saaty (1980) projected the model to be a reliable and powerful method for defining the importance of the selection criteria. The scholar also stated that the model evaluates the performance of each criterion. Importantly, Kahraman et al. (2003) pinpointed that the AHP's optimality is informed by its ability to consider different value systems that the traditional supply chains have.

Furthermore, De Boer et al. (1998) stated that the outranking model is an effective technique to solve MCDM with qualitative and quantitative features. The scholars explained that the outranking methods can be applied when the number of suppliers is small or when there are relatively limited data. The scholars stipulated that this method has the advantage that it can be used in cases with a small number of suppliers because not all the traditional decision-making techniques can work properly under this condition.

The linear weighting model is one of the MCDM models. The model was proposed by Timmerman (1986b). In this method, the suppliers are evaluated according to different criteria and then the final results of the evaluation are merged into one result. The technique of the weighted point method is based on attributes weighted by the purchaser. After that, the weight for every attribute is multiplied by the performance results that were found earlier. Lastly, the ranking of each supplier is determined by finding the total of the results of multiplication. Applying the weighted point method allows the organisation to evaluate different factors and allocate their weights depending on the organisation's needs and requirements. However, the main disadvantage of this method is that it is not easy to consider the qualitative evaluation criteria in effective ways.

The categorical method was developed by Timmerman (1986b), and its effectiveness depends on the dynamics that define different companies. The company's experience is the foundation of the categorical method. With this method, different departments in an organisation, such as the purchasing, quality control, and production departments, evaluate the supplier's performance based on their interests and needs. During the

evaluation process, these departments give either an acceptable, unacceptable or neutral score for the selected criteria for each supplier. After that, the supplier selection committee, which includes members from different departments in the organisation, conducts a meeting with the buyer to discuss the evaluation results. The overall performance score for the supplier is then determined. The main advantage of this method is that it makes the evaluation process clearer and well structured. The simplicity of this method makes it easy to implement in any organisation, using available information. In this method, the attributes are weighted equally; thus, the final decision mainly depends on the individual's perspective and this is a disadvantage of the categorical method.

The above analyses of models show that the MCDM method remains an essential technique for assessing and selecting suppliers. Yildiz and Yayla (2015, p. 159) agreed that an MCDM process helps purchasers or companies to identify the challenges arising from the selection of a supplier. Dubey et al. (2015) also supported the idea that the use of an MCDM process makes it easy for the company to address problems and the method promotes better decision-making. Furthermore, these authors added that selecting suitable suppliers helps a company to reduce production costs and increases the company's competitiveness.

The purpose of MCDM, as seen through its application, is to address challenges that arise in decision-making processes that involve more than one criterion. The focus of MCDM is to provide a structure in which these challenges can be addressed. The MCDM method and mathematical techniques have also been used to identify the factors that influence agile suppliers. The selection of agile suppliers is a decision-making process that requires several criteria and the use of the MCDM method. One of the important points to note is that the use of hybrid methods produces better results, which can be attained by MCDM. And, the use of hybrid techniques has also led to the development of new MCDM methods that fit specific industries, depending on the needs of the objectives of the researchers (Beikkhakhian et al., 2015).

Feurtey et al. (2016) used MCDM to identify the institutional factors that affect decision-making in the creation of wind energy policies in France and Quebec. Their study involved weighing different criteria to identify the factors in that industry. The study identified political factors and social acceptance issues as the main institutional factors

that influence decision-making in the wind energy sector. These authors noted that the environmental factor is one of the emerging areas that has affected the supplier selection process in that industry. This study showed that MCDM could be used for any industry, especially when suppliers are not only required to boost their performance, but they also need to integrate environmental concerns into their operations. Thanki et al. (2016) used the MCDM method to evaluate the impact of green practices on the performance of firms and suppliers. The researchers found that incorporating green practices in supplier operations improves their performance and helps to increase the value of their buying company.

The above evidence reveals that MCDM is a relevant technique used in supplier selection by different industries. Barla (2003) expatiated on MCDM being a mathematical model. The scholar stated that mathematical techniques simplify decision-making and enable decision makers to act accordingly and in a timely manner. In this view, and as mentioned earlier, the AHP technique is key to the MCDM method. The AHP technique seems to be suitable for the goals of the current research. Beikkhakhian et al. (2015) argued that agile suppliers can be selected with a good technique.

AHP is a technique applied in MCDM that helps to simplify a complex problem by dividing it into a multilevel structure. According to Gorener (2012), AHP creates a hierarchical analysis of value priorities within the manufacturing sector and companies to define the importance of relations between stakeholders. Through this method, decision makers can perform comparisons in pairs to determine the importance of the variables in the structure. The method can be applied where there is subjectivity and is also suitable when the criteria used can be divided into sub-criteria organised hierarchically. The method can also be used to determine relative priorities when comparisons are done in pairs within the structures (Deng et al., 2014).

One of the unique features of AHP is that it uses a hierarchy to solve MCDM challenges. The structure or the hierarchy formed in AHP has three levels (Figure 2.5), namely the goal, the criteria, and the alternatives (Chan et al., 2008; Kambiz et al., 2012). The procedure for the technique has three steps. First, the hierarchy is designed. This involves goal definition, identification of evaluation factors, identification of alternatives, assignment of the criteria, and completion of the hierarchy. The second

step involves the identification of priorities where the pairwise comparison is made. The making of comparisons requires a scale of numbers that can show the number of times that one element becomes more dominant than another. The third step is the combination and evaluation step, where the weight of each of the alternatives is evaluated. The priorities obtained in the second step are then used to weigh the priorities for each element to obtain the overall priority (Deng et al., 2014).

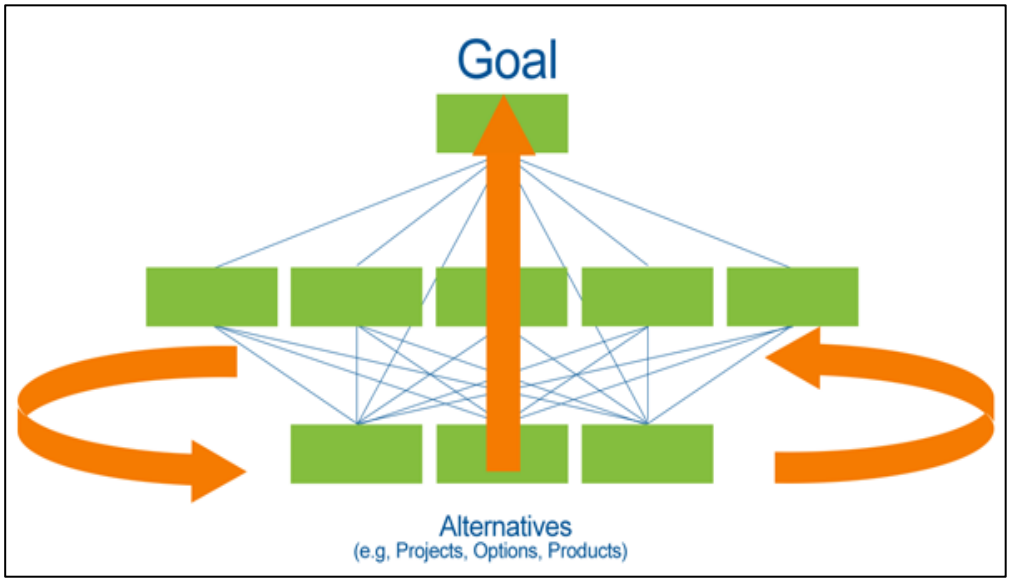


Figure 2.5 AHP Structure

The decision-making in AHP can be in one of three structures. The embrace of the hierarchical process in the AHP framework facilitates the ranking of appropriate values on their degree of relevance (Narasimhan & Jayaram, 1998). These structures are the hierarchy, priority, and consistency structures. Classification through the hierarchy structure allows a simple evaluation of the results and easy verification. The priority structure is based on estimation by experts where the factor influences are compared.

Albert et al. (2016) used AHP to develop a blueprint for the use of smartphone apps that have the potential to reduce road accidents. Experts' opinions are evaluated through the AHP and apps mapping is also incorporated to identify apps that could help to reduce accidents and would be easily accepted by users. The criteria used for this study were risky driving behaviour and general acceptance of apps. The criterion for general acceptance was divided into three: the willingness of the individual, support from the public and potential functionality. The research also involved 37 experts who considered the alternatives against the criteria. The results of the study showed that

the apps that provided collision warnings, texting prevention and voice control were seen as apps that could potentially be used to reduce or prevent crashes. Besikci et al. (2016) stated that AHP has also been used to identify technology and practices that could be used in the design of ships to lower fuel consumption.

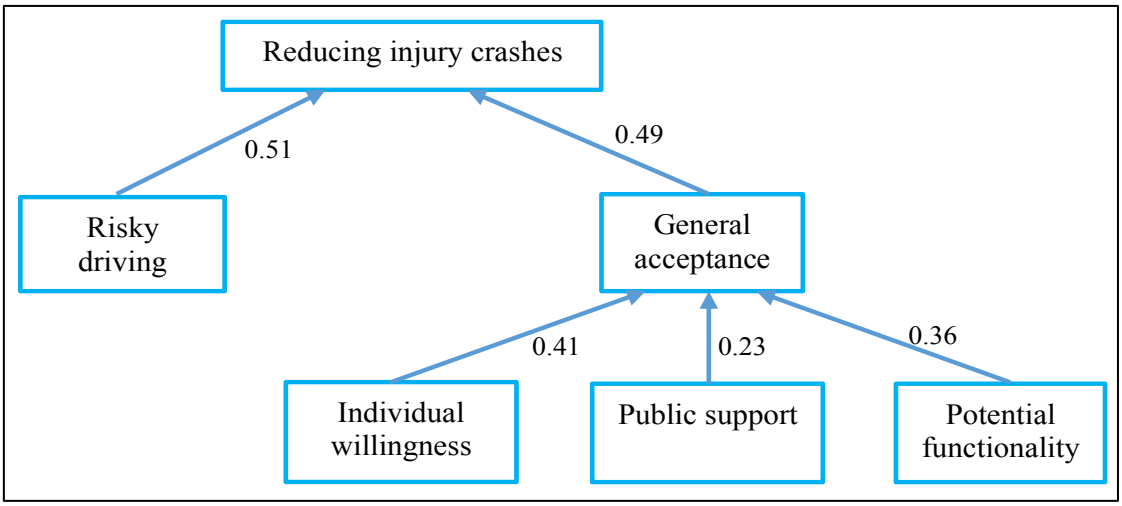


Figure 2.6 The Three Levels of AHP: Goal at the Top, Criteria in the Middle and Alternatives at the Bottom (Albert et al., 2016)

The studies discussed above show how researchers have been successful in solving MCDM problems using the AHP technique. The fact that AHP enables researchers or decision makers to simplify a complex problem into a hierarchical structure with multiple levels (Figure 2.6) means that decision makers find it easy to solve MCDM problems with this technique (Çebi & Bayraktar, 2003). Decision makers are also able to make pairwise comparisons, which ensure that the decision made is credible. All these points make AHP suitable for use in the creation of a model to be used in the selection process for the current research.

2.8 Theoretical Framework for the Current Research

From the above sections, it can be noted that there are no comprehensive models that address all compelling criteria. It can be noted that not all the models considered the key selection criteria, such as cost, quality, and delivery, alongside the new perspectives, such as sustainability, green practices, CSR and cultural factors. Although there is an abundance of research available on the topic of supplier selection, very little attempt has been made to include and examine cultural factors in the supplier selection model. A supplier's cultural aspects are relevant to the existing factors of

supplier selection; they broaden the perspective, which ultimately affects the success of the company in the supplier selection process. This current research attempts to include the supplier's cultural aspects alongside the existing criteria of supplier selection. This criterion is incorporated with other key selection criteria into one supplier selection criteria framework, which is tested in a typical facility.

In today's business world, where everyone is seeking organisational and project performance improvement, businesses and organisations in different industries are continually searching for ways to guarantee the success of their projects. One of the typical industries that represent today's business world is the construction industry. The construction industry is selected for data collection and research investigation in this study due to the importance of the industry and its huge effects on national growth.

According to the above discussions, the current research drew its framework from TCT, institutionalisation theory and agency theory. All monetary-related criteria were developed with regard to the key assumption of TCT. Similarly, all organisational-related criteria were defined with regard to the institutionalisation theory. Likewise, all communication or relationship-related criteria were outlined for the agency theory. Accordingly, the proposed criteria were grouped into nine purposely to align similar sub-criteria. The grouping was based on the literature of supplier selection criteria and SCM in the construction industry. The following table shows the theoretical framework.

Table 2.2 Criteria and Sub-criteria for the Research Framework

No.	Criteria	Sub-criteria	Theory
1	Supplier Experience	1. Performance history and delivery 2. Reputation 3. Innovation and creativity 4. Amount of past business 5. Marketing position 6. Supplier expertise	Agency Theory
2	Supplier Financial Position	1. Financial stability 2. Cost and price 3. Desire for business 4. Quantity discount 5. Warranty and aftersales services	TCT
3	Communication and Responsiveness	1. Ability to fill emergency orders 2. Response to change 3. Process flexibility 4. Customer service	Agency Theory
4	Supplier Quality Management	1. Quality system 2. Quality of support service 3. Meeting regulatory requirements 4. Production facilities and capabilities 5. Reliability 6. Organisational leadership	Institutional Theory
5	Supplier Process Performance	1. Bidding procedure 2. Technological system and technical support 3. Future manufacturing capability	Institutional Theory

		4. Process capability 5. Design / process improvement	
6	Supplier Cultural Factors	1. A local company (patriotism) 2. Religious qualities or beliefs (loyalty or bias) 3. History and heritage	Institutional Theory
7	Supplier Green Practice	1. Waste disposal schemes 2. Green procurement 3. Green technology / operations 4. Green certifications	Institutional Theory
8	Corporate Social Responsibility (CSR)	1. Ethical behaviour 2. Philanthropic responsibility 3. Social sustainability 4. Environmental sustainability 5. Economic sustainability	Institutional Theory
9	Supplier Logistics Performance	1. Location 2. Geographical distance 3. Packaging 4. Post-production configuration / ease of assembly 5. Hazardous goods management	Institutional Theory

Table 2.2 shows that there are nine key criteria and 44 sub-criteria. The key criteria represent the most important criteria that the construction companies could consider in their supplier selection. The sub-criteria are also important criteria that affect the specific decision of supplier selection in the construction industry. These criteria were partly retrieved from previous works, such as Watt et al. (2010) and Kilincci and Aslı Onal (2011). The above table shows that the institutionalisation theory is quite related to the current research criteria. The possible criteria relating to supplier quality management and process performance, cultural factors, green practices, CSR and supplier logistics performance belong to the institutionalisation theory. The supplier

experience and communication belong to the agency theory because these criteria deal with the seller–buyer relationship. As shown in Table 2.2, only supplier financial position related to money and it belongs to TCT. A detailed description of each criterion and its sub-criteria is provided in the following subsections.

2.8.1 Supplier Experience

This criterion is composed of six sub-criteria: performance history and delivery; reputation; innovation and creativity; the amount of past business; marketing position; and supplier expertise. Most of these criteria are mentioned in the literature as important factors in decision-making for the supplier selection process. A supplier's past performance is an essential criterion in identifying the best supplier when awarding contracts in the private sector (Albano et al., 2006; Van de Rijt et al., 2010; Watt et al., 2010; Wong et al., 2000) and in the public sector (Mills, 2005; Shugart, 2005; Snider & Walkner, 2009; Spagnolo, 2012). Past performance in government contracts is an indicator of the quality of future performance (Bradshaw & Chang, 2013; Doni, 2006; Guerrero & Kirkpatrick, 2001; Kelman, 1990) and is used to select contractors for federal procurements in the USA (Causey, 2000; Manuel, 2013). Coggburn (2003), in a study of chief procurement officers in the USA, noted that past performance is considered as a fundamental factor when awarding contracts. According to Snider and Walkner (2009), the Federal Acquisition Regulation states that past performance information is crucial for future selection purposes. Hence, the ability to contract in the next year is determined by positive performance on contracts won in a given previous year.

Delivering products and services on time is an important consideration in past performance or supplier experience. According to Stanley and Wisner (2001), quality and delivery on time are the core factors affecting performance evaluation. Smytka and Clemens (1993) and van Weele (1994) evaluated delivery performance and its applicability to the field of supplier selection. Some other scholars such as Choi and Hartley (1996) also examined the quality and cost. These scholars stated that delivery performance is an important supplier attribute that shows the expertise and experience of the supplier.

Furthermore, poor delivery performance leads to disruption in production operations and hence results in a decrease in sales performance. Vonderembse and Tracey (1999) highlighted that on-time delivery of services or products by a supplier is paramount as it helps planning and implementation. According to Shin et al. (2000), reduced delivery time assists in maintaining stock levels and increasing turnover. Besides delivery performance, managers should select suppliers based on other factors, such as delivery capability. Associations and loyalty between buyers and suppliers occur as a result of promised service delivery (Weber, 2001). According to So (2000), the companies that are inconsistent in their delivery times lose credibility with their customers, which negates the overall performance of such organisations. This is the reason many companies monitor and maintain their delivery times as agreed with their suppliers. Shin et al. (2000) showed that the choice of supplier is based on standards of supply, the speed of delivery, and flexibility. These authors added that quality and delivery are certainly prerequisites for supplier selection. As far back as 1966, Dickson (1966) highlighted that meeting delivery deadlines and ensuring quality were the most crucial supplier selection criteria in the relationship between suppliers and buyers. Choi and Hartley (1996) also noted that because suppliers that do not follow such specifications are dropped in the screening phase itself, the specifications ensure continuous production.

An indication of a supplier's experience is their reputation. According to Wu et al. (2016), a supplier's reputation is a reflection of their performance history based on the experiences of its customers. Poor reputation is synonymous with poor customer satisfaction. Accordingly, Parkouhi and Ghadikolaei (2017) illustrated that a poor reputation can be the result of unsatisfactory performance in terms of past competitive performance, response to the market, and production results. Reputation is also important in the supplier selection process and is used to rank suppliers (Chen, 2011). Reputation can be associated with a number of different supplier attributes; for example, it can be affected by the quality and technical capability of a supplier (Dargi et al., 2014). Reputation is also linked to environmental issues in terms of green image, health and safety in the workplace, unethical behaviour and social sustainability (Ghadimi & Heavey, 2014; Goebel et al., 2012) as well as being a factor of consideration when monitoring CSR (Xu et al., 2013).

A further sub-criterion of supplier experience is innovation and creativity. Capacity for innovation is the ability to adapt to changes in customers' requirements (Dursun & Karsak, 2013). Innovation can be considered as the percentage of profit that is spent on research and development, or when profit is dedicated to innovation in service activity, such as meeting customer demands, speed of delivery, and agility (Zouggari & Benyoucef, 2012). These are important considerations in supplier selection. A lack of innovation or investment in innovation can impede the development of differentiated products and quality (Chen, 2011). Therefore, suppliers need to have strong research and development to produce technological innovations and to adapt to turbulence in the market (Rajesh & Ravi, 2015). One of the main attributes of innovation is technological innovation, which includes being technologically capable of adapting to customer needs (Wu et al., 2016). Customers also apply pressure on companies in the form of environmental pressure (Gupta et al., 2015). Innovation has been associated with green innovation and it is a selection criterion because companies must achieve green practices in the supply chain (Gupta & Barua, 2017). Innovation can also be seen as the capability of suppliers in research and development to innovate green technologies, practices, and methods (Luthra et al., 2017) which contribute to environmentally friendly solutions (Rezaei et al., 2016).

2.8.2 Supplier Financial Position

This criterion is comprised of five sub-criteria: financial stability; quantity discount; cost and price; desire for business; and warranty and aftersales services. Hamdan and Cheaitou (2017a), Kilincci and Aslı Onal (2011) and Cousins et al. (2006) stated that these sub-criteria are mentioned in the literature as important factors in supplier selection decision-making. For example, Lehmann and O'Shaughnessy, (1982) argued that businesses should consider the cost elements: whether the supplier can accept reducing the price or can offer a reasonable service price. These scholars also stated that, in the past, the cost was the main factor affecting a company's choice of supplier and the companies collaborated with specific suppliers to achieve lower prices for goods and services.

By considering the cost and price, an organisation can manage operational costs; these include the cost of redoing work, unit costs, inventory holding costs and the cost of maintenance. The cost saving can be used for business activities, such as

production planning and the management of stock. The cost of raw material accounts for up to 70% of the overall company cost in most industries (Ghodsypour & O'Brien, 1998). The companies that choose deliveries guided by necessary pricing criteria to gain cost efficiencies benefit from enhanced cash availability and management. According to Cousins et al. (2006), the selection of appropriate delivery based on the correct price is very important for a firm to maximise its profits. Hence, Kilincci and Aslı Onal (2011) stated that the choice of suppliers guided by price alone standardised the way of selecting suppliers. The authors also stated that the price of working with a supplier is calculated and the cheapest supplier selected.

Huge investments in any project are risky, as cash flow needs to be restricted, apart from having other sources of revenue. Project funding can be changed when a supplier fails to deliver a contract. Hence, companies should be proactive in assessing the financial stability of their suppliers to minimise risk and enhance confidence in any new project. Good reputation secures new contracts; however, a good reputation is placed at risk when a business does not assess the financial ability of its suppliers. Failure by the suppliers to deliver as expected affects their partners. They may not be able to meet their obligations and, thus, mistrust develops with their customers. Lack of safety insurance for the third party can damage a company's reputation, apart from the financial instability of suppliers. Thus, buyers should be mindful of the financial position of their partners when making decisions. To avoid risks associated with financial position, the company should look for financially stable partners. The financial health of a supplier is vital in procurement, as the larger the contract, the greater the number of terms. The supplier's financial stability may, therefore, reduce costs because of increased financial confidence in the supplier (Ellram, 1990).

According to a report by the EU (2008) on supplier evaluation in Germany, the sourcing of competitive suppliers should be done openly to achieve value for money in procurement. A supplier's financial capacity, capability, and embracing of new technology should be the guiding principles. A study by Mwikali and Kavale (2012) showed that cost factors, technical capacity, assessment of quality, the profile of an organisation, and factors of risk affect supplier selection in procurement.

As an example, to support the above arguments, Danese (2013), in her study on supplier selection determinants in the Pakistan Telecom industry, noted that the

supplier's financial expertise is among the key factors that determine the ultimate performance of suppliers and procurement processes. Furthermore, a study at Makerere University in Uganda on procurement processes established that a reduction in purchasing cost through effective evaluations is a reason for successful procurement processes. Ghodsypour and O'Brien (1998) agreed that cost, quality, and service are crucial.

Another important criterion in the supplier's financial position is quantity discount. A decrease in the price of each unit as a result of an increase in the size of an order is referred to as a quantity discount. Quantity discounts are used strategically to motivate buying companies and to increase the amounts that they buy. In reference to quantity discounts in the procurement process, it allows economies of scale through the correct choice of quantities that can be allocated to each supplier (Hamdan & Cheaitou, 2017a).

There are three main types of quantity discounts: business volume quantity discounts, incremental quantity discounts, and all-unit quantity discounts (Hamdan & Cheaitou, 2017b). For the incremental quantity discount, the discounted price is applied within the price break quantity, and prices are allocated to units that belong to the different price breaks (Ayhan & Kilic, 2015). As for business volume discounts, discounts are proportional to the total value of the sales, and finally, an all-unit quantity discount is when the size of the order is for a specific quantity, and the discounted price is applied from the first unit (Ayhan & Kilic, 2015).

The length of the warranty is also an important consideration in supplier selection (Dweiri et al., 2016; Igarashi, et al., 2015). Cristea and Cristea (2017) stated that warranty terms are like a guarantee made by a supplier; replacements or repairs are provided for a product that does not have the properties that were described. In a situation where there are discounts offered by suppliers, buying companies need to consider who to buy from and in what quantities, and multiple criteria are considered in this process. Importantly, the warranty is one of them (Xia & Wu, 2007). Another reason why the warranty is an important consideration in supplier selection is that it can also be considered as a cost, or warranty cost (Shahanaghi & Yazdian, 2009). Even though a supplier from a more developed country is preferred over a supplier

from a low-cost country, the warranty also plays a role in the selection decision-making (Carter et al., 2010).

2.8.3 Communication and Responsiveness

This criterion is composed of four sub-criteria: response-to-change; ability to fill emergency orders; process flexibility; and customer service. Most of these sub-criteria are mentioned in the literature as important factors in the decision-making of the supplier selection process. Christopher and Juttner (2000), Yusuf et al. (1999), and Gunasekaran (1999) viewed agility or responsiveness as feedback to the high level of complications in present-day markets. Naylor et al. (1999) perceived agility as a way of using knowledge in a virtual corporation and market to take advantage of the high-value opportunities in an uncertain marketplace. Christopher (2000) and Prater et al. (2001) observed that supply chain agility in an organisation is determined by different types of flexibilities. According to Christopher (2000), flexible manufacturing systems are determinants of agility.

Furthermore, responsiveness is an important selection criterion in the construction industry, and it has been expressed as responsiveness to customer needs (Shahanaghi & Yazdian, 2009). Responsiveness has been defined as the speed at which tasks are carried out and the speed at which the supply chain provides products to customers, for example, cycle-time metrics. Wherever an agile strategy is being used, as opposed to a lean strategy, responsiveness should be a priority. Both agility and responsiveness are regarded as a response-to-change in the current research (Lima-Junior & Carpinetti, 2016).

Similar to the response-to-change, the ability to fill emergency orders is also a communication and responsiveness criterion. According to Rajesh and Ravi (2015), responsiveness includes the supplier having good visibility and supply chain velocity. These scholars explained that supply chain velocity means that the supplier is sufficiently responsive to reduce the time that elapses from when the order is placed to the time of delivery. Christopher (2010) also highlighted that a supplier should have enough acceleration to meet fluctuations in demand. Responsiveness also includes visibility, which is the supplier's ability to see both upstream and downstream inventories clearly, as well as clarity of demand and supply, and purchase and

production schedules. Peck (2005) added that sharing information enhances the supplier's visibility of the supply chain, both upstream and downstream.

Regarding emergency orders, sometimes an extremely large number of requisitions is hard to fulfil. There are many justifications for orders that are unplanned for and which are unavoidable in projects. Many factors lead to not fulfilling emergency orders, for example faulty inventory control, budgeting or production planning of an inferior nature, and a lack of trust in the supplier's capability to deliver the materials to the customer at the right time. Regardless of the reasons for such orders, they are usually expensive. Such orders are costly because of the increased chance of error when done at speed. The use of suppliers who are already approved and an e-procurement system may reduce the problem, as the lead time for order processing will be reduced, and buyers are allowed to issue orders against contracts already in existence with the supplier, hence the problem is controlled (Leenders et al., 2006). Generally, the ability of suppliers to respond to emergency orders can help the buying company to achieve its targets. Hence, the ability to fulfil an emergency order is a crucial factor to be considered in the supplier selection.

Process flexibility is another important criterion. Gerwin (1993) asserted that flexibility is a counter-adaptive measure of uncertainties in the market. Upton (1994) and Morlok and Chang (2004) stated that it reflects the capability of a system to shift in response to cost, performance, and changes in time or effort. Tam and Tummala (2001) added that in supplier selection, a delivery performance index based on the availability of transportation, reliability, and serviceability should be assessed to provide levels of satisfaction as outlined in certain guidelines. These scholars stated that this improves levels of customer satisfaction. Vickery et al. (1999) stated that flexibility, in terms of responsiveness, consists of volume flexibility, distribution flexibility, and product flexibility. Prater et al. (2001) contributed that the key determinants of the flexibility of the supply chain include manufacturing, speed, the flexibility of sourcing, and delivery. Similarly, Tachizawa and Thomsen (2007) contributed that the flexibility of a supply chain is directly proportional to improvements in flexible sourcing and supplier responsiveness. This could be the reason for Swafford et al. (2006) observing that there is a relationship between sourcing, manufacturing, design flexibilities and logistics.

Moreover, Upton (1995) described flexibility as the ability to adapt to changing conditions in a way that ensures the continuity of the organisation, as well as the ability to respond to changes inside and outside the system. Fitzgerald and Siddiqui (2002) viewed flexibility as a characteristic of organisations that enables them to deal with the threats and opportunities that arise due to the increased dynamics and complexity of environments. Vokurka and O'Leary-Kelly (2000) mentioned 15 of the flexibility measures for production; most of them are similar to those reported by Koste and Malhotra (1999). These measures and flexibility types have been investigated by Koste et al. (2004), Zhang et al. (2003) and Gerwin (1993). Naim et al. (2006) summarised them as natural flexibility types: machine, process, operation, capacity, and re-routing flexibility; and product, mix, volume, delivery, and access flexibility. Vokurka and O'Leary-Kelly (2000) also summarised that the flexibility of a vendor refers to the common types of flexibility offered by different vendors in the supply chain.

The last criterion of communication and responsiveness is customer service. Vickery et al. (2003) utilised customer service performance and financial results as key index systems when studying the performance of supply chain strategy integrations. Hence, Kadkhodazadeh and Morovati Sharifabadi (2012) noted that most previous researchers have focused on the lean performance of the suppliers, but few have focused on responsiveness or agile performance. These scholars emphasised that the advantages of considering both are the low cost, high quality, and capability of performing quickly and flexibility when required. Li et al. (2005) also argued that different performance measures have been used to evaluate the effectiveness of supply chain management strategies. These authors used marketing time and delivery reliability to measure the possible value of six builds of SCM. Studies analysed information sharing, customer relations, supplier partnerships, information quality, postponements, and internal lean operations. Therefore, the current research considered customer service and performance as important elements for supplier selection.

2.8.4 Quality Management

This criterion is composed of six sub-criteria: quality system; quality of support service; meeting regulatory requirements; production facilities and capabilities; reliability; and organisational leadership. These criteria are mentioned in the literature as important

factors in supplier selection decision-making. Quality means the quality of conformance, which is defined by the absence of defects and quality of design. This is measured by the degree of customer satisfaction with the features and characteristics of a product (APICS, 1999). Supplier quality management systems are being embraced by manufacturers to improve supplier quality. Supplier quality management refers to a set of activities adopted to enhance organisational performance (Shin et al., 2000). The activities include measuring and tracking the cost of supplier quality, performance scorecards to measure supplier performance, conducting supplier audits, and active communication channels. Forker (1999) argued that a firm's output can be only as good as the quality performance of its suppliers.

The quality of support service is an essential criterion. This is regarded as part of the supplier quality management concept. This concept is seen as the integration of strategic practices that cut across inter-organisational limitations for the satisfaction of both new and older customers (Harland et al., 1999). Yeung and Lo (2002) looked at supplier quality management from the angle of the efforts needed by managers to provide an environment of operation in which manufacturers integrate their supplier capabilities into their processes. These authors explained that supplier management often enables the supplier to offer support services.

Furthermore, meeting regulatory requirements is also a factor of supplier selection. It is considered in light of CSR. CSR practices are considered in the supplier selection process and this includes regulatory compliance (Govindan et al., 2018). Environmental regulation compliance is something that is considered in the supplier evaluation process and part of the sustainability practice of suppliers is their response to regulations, such as those on hazardous materials and green practices (Trapp & Sarkis, 2016) and regulations for sustainable logistics (Sarkis & Dhavale, 2015). Compliance with these regulations is something that suppliers try to achieve to avoid negative publicity with the environment and potential loss of business (Sarkis & Dhavale, 2015).

Another important criterion is the ability of the supplier to provide the correct product at the agreed quality and price, on a timely basis and in an effective way. This is important to any organisation as it affects business performance (Tracey & Chong, 2001; Zhang et al., 2006). The smooth running of business operations is determined

by the selection of an appropriate supplier. This can be attained when the appropriate quality of services and products from a supplier helps to improve the delivery of the final products or services to users. Suppliers who maintain their product quality have more time to concentrate on enhancing their delivery service, as there are no return products and few reworks. Similarly, such suppliers have a good manufacturing lead time that is reduced because of their proper management, planning, and appropriate delivery time. Hence, the ability of suppliers to provide quality products on time is an indication of their capability to meet the required delivery and quality standards (Kannan & Tan, 2002).

The supplier's reliability is important. Kumar et al. (2009) examined supplier selection challenges among small-, medium-, and large-scale industries. The focus was on the price of the product, the cost of transportation, quality certification, product quality, the goodwill of the supplier, supplier reliability, their experience, lead time and available stock. These were the factors considered in supplier selection. Their study concluded that supplier reliability, product quality and the experience of the vendor were the top three criteria for supplier selection.

In the supply chain, the reliability of suppliers is crucial as it reduces uncertainty in supply. This is because their reliability tends to be informed by procedural rationality, which provides a logical screening tool in the identification of the appropriate suppliers (Riedl et al., 2013). According to Ansari and Modarres (1988), the selection and evaluation of a supplier's ability to deliver should be based on their ability to supply products of high quality, deliver supply without delay, provide consistent supply, supply in small portions and deliver supplies that are as ordered. Willingness and capacity to improve should be added to the list (Hall, 1983). Carr and Truesdale (1992) stated that Nissan's supplier selection team visit supplier factories often to evaluate products, from the development and design to the process of manufacturing, to enhance delivery reliability.

Besides the capability and reliability of suppliers, organisational leadership has been indicated as a crucial subject in the field of organisational behaviour. Stogdill and Coons (1957) viewed leadership as a personal behaviour that guides a group towards achieving a common goal. Fry (2003) viewed leadership as the tools to offer inspiring desires and enhance the staff's potential for development and growth. According to

Lee and Chuang (2009), an outstanding leader not only motivates employees but also meets the threshold for achieving organisational goals. Thus, Koontz and Donnell (1993) stated that the performance of an organisation is measured by its ability to attain objectives, such as increased profit, increased quality, increased products, huge market segment, best financial benefits and sustainability at pre-planned moments with the right strategies. These authors affirmed that organisational leadership enables it to attain these objectives. Therefore, Rowe (2001), Lado et al., (1992) and Avolio (1999) argued that understanding how leadership affects performance is equally vital, as leadership is seen by several strategists as one of the main forces used to enhance a project's performance. These scholars argued that good leadership is a major contributor to project progress and business progress enhancement. These scholars suggested that it is supposed to be among factors to be considered in the selection of suppliers.

Vonderembse and Tracey (1999) illustrated that external and internal aspects must be considered, as supply chain entities belong to various market sectors, such as manufacturing, retailing and distribution. These authors stated that product quality, delivery of service, supplier relations, price, decision-making, the procurement policy of the government, and business-related ethics are among the influencing criteria. The authors noted that these criteria can affect the supply chain by impacting the entities of supplier selection. Supply chain management is relevant and considered in the current research.

2.8.5 Supplier Process Performance

This criterion is composed of five sub-criteria: the bidding procedure; technological systems and technical support; future manufacturing capability; process capability; and design/process improvement. Several scholars, such as Chen and Chao (2012), Sodenkamp et al. (2016) and Rao et al. (2017) argued that these criteria are important factors in the decision-making for supplier selection.

To have an effective and feasible bidding procedure, the buying company needs to establish some principles. These include that the quality should not be less than the minimum expected value, the price should not be more than the reserve, delivery times cannot exceed the established time limit, and the supplier's maximum supply quantity

can be limited (Rao et al., 2017). The procedure of bidding is different from one country to another and is determined by businesses as well as suppliers. In the USA, for example, there have been strict regulations of the procurement processes. Such initiative is meant to prevent tenders from being given to the bidder with the lowest qualification (Bajari & Lewis, 2011; Potoski, 2008). In the European Union, they do not largely use the lowest price as the main criterion for selection; on the contrary, supplier selection includes a combination of price and quality (Bajari & Lewis, 2011). Thus, the bidding procedure is an essential criterion.

Technical capability is acknowledged as one of the main supplier selection criteria (Ayhan & Kilic, 2015; Chen & Chao, 2012; Mukherjee, 2014; Pal et al., 2013; Polat & Eray, 2015; Waris et al., 2014; You et al., 2015). Technical capability is an important attribute of a supplier. It is important for both sustainability and meeting current and future demand (Büyüközkan & Çifçi, 2011). Furthermore, technical capability requires the supplier to keep up with recent innovations in technology or turbulent events in the market. Furthermore, technical capability is required to maintain quality standards and reduce any risks. For a supplier to be able to offer technical support, they need to have robust research and development (Rajesh & Ravi, 2015).

The potential technical ability of a supplier is important in the buyer–supplier relationship because this relationship can be based on the integration of processes, application systems, and organisational integration. Any potential changes in the future in terms of technology need to be anticipated to maintain this integration (Chen, 2011). Supplier development activities include improving technical expertise; this is something that the buyer can help with by collaborating with the supplier (Akman, 2015). It also entails the identification of stakeholders in the supply process who reflect the image of the organisation in the form of culture and productivity (Rogers et al., 2007). Finally, the buying company should have the expertise, knowledge, and skills required to make judgements about a supplier's performance in terms of technical performance during the production process (Sodenkamp et al., 2016).

For the design process criterion, Chen (2011) stated that packing ability is ranked 18th out of 23 criteria, according to the Dickson (1966) importance ranking, as shown in Figure 2.2. However, it is considered more important in Weber's ranking (Weber et al., 1991). This lower consideration has also been reported by Erginel and Gecer (2016),

who said that it is ranked 10th out of 14 criteria. Packing ability is important because it is associated with quality (Şen et al., 2008) and optimal packing allows the buyer to avoid repacking (Bottani & Rizzi, 2008).

2.8.6 Cultural Factors

Although there is abundant research available on the topic of supplier selection, very little attempt has been made to include and examine cultural factors as a criterion among selection criteria in supplier selection models. Rose (2001) and Livanis et al. (2016) explained that the supplier's cultural aspects are relevant to the existing factors of supplier selection. These scholars explained further that the cultural factors of suppliers broaden the perspective and have an impact on the company's performance.

The suppliers in a particular country may have a strong attachment to nationhood in that they represent the cultural values and heritage of their country and, therefore, there may be a sense of loyalty in their decision-making. It is important to note that the cultural factors considered here are those attributed to the supplier. This dimension is composed of three sub-criteria: local company (patriotism); cultural or religious qualities or beliefs (loyalty or bias); and history and heritage/tradition in the country. If a supplier is a local company and not part of an international organisation, then the decision makers may, through a sense of patriotism, be loyal to the local supplier. The supplier may have religious or cultural attributes that are important to decision makers, not just in the sense of being ethical, but in terms of religious or cultural affinity. Furthermore, a supplier may be well established in a country and part of the cultural and traditional heritage. Unless buyers perceive that they will get a noticeable reduction in cost or improved delivery, they will prefer to purchase domestically, and this preference may also be influenced by patriotism (Becker & El-Said, 2013). According to Rose (2001), patriotism and political links are important attributes of suppliers. A supplier may have a connection with powerful political personalities, or it may be considered that buying from local suppliers is an act of patriotism (Rose, 2001). The cultural attributes of a supplier's host nation can, therefore, have an impact on supplier section decisions (Livanis et al., 2016).

The Key Mediating Variable (KMV) model developed by Morgan and Hunt (1994) looked at the relational constructs between organisations. Morgan and Hunt (1994)

defined shared values as the common beliefs that individuals have regarding behaviour, policies and goals and the appropriateness of constructs. Moreover, Hofstede et al. (1990) explained organisational/corporate culture as the characteristics of being influenced by history, social construction and its immutability. Due to limited literary work on the cultural factors and the importance of these factors, the current research investigates them.

2.8.7 Green Practices

This criterion is composed of four sub-criteria: waste disposal schemes; green procurement; green technology/operations; and green certifications. Katsikeas and Leonidou (1996), Thorelli and Glowacka (1995) and Min (1994) explained the roles of green practices. These scholars highlighted that the criteria need to be considered in the decision-making of supplier selection.

There is an issue that price, quality and lead times are often used as selection criteria, but little attention is given to environmental criteria as part of overall supplier selection (Shen & Yu, 2013). Research conducted by various scholars, consisting of Piercy et al. (1997) and Katsikeas and Leonidou (1996), highlighted the significant issues in worldwide market purchases and the impact of environmental factors on purchasing behaviour (Deng & Wortzel, 1995). There has been an increase in environmental awareness and awareness of the associated legal and regulatory requirements, as well as shareholder and consumer pressure, which has meant that green purchasing has become an important issue (Shen & Yu, 2013). Furthermore, as part of green supply chain management, companies are measuring their supplier's environmental performance. In supply chain management, impacts on the environment need to be managed for all parts of the supply chain, including consumption. In response to these requirements, several programmes have been introduced, including ISO 14000 and total quality environmental management.

Selecting existing green suppliers is one way of ensuring that supply chains are green. This is because if there are, for example, hazardous substances involved, they can affect the whole supply chain. It is therefore essential that purchasing decisions are environmentally conscious. They should be based on a set of criteria that is used to determine the suitability of suppliers as partners in a green supply chain (Shen & Yu,

2013). Green supply chain management (GSCM) practices, of which supplier selection is a crucial part, have been addressed in many national contexts in the developed world, although little is known about the situation in the developing world.

Waste disposal is another important green issue in supplier selection. Improper waste disposal is considered to be a CSR issue, whereby organisations are responsible for preventing pollution (Kumar et al., 2014). Disposal as a green issue is in terms of the design of products; they should be designed in a way that facilitates their safe disposal. Similarly, the cost of disposal of hazardous materials influences supplier selection decisions (Winter & Lasch, 2016).

Many organisations have been under increasing pressure to reduce their impact on the environment, particularly from emissions across the whole supply chain, while at the same time reducing costs and remaining competitive (Jain et al., 2016). Most of the selection criteria and approaches to the supply chain have focused on reducing costs while ignoring environmental criteria. However, because of the green movement, there are now cost components attributed to emission activities (Jain et al., 2016). Hence, Hashemi et al. (2015) explained that green procurement has become increasingly important because of growing concerns about the impacts that businesses have on the environment. These scholars also stated that the impacts include pollution, too much waste, and diminishing resources. The scholars stated further that there is also pressure from governments and that consumer awareness about environmental issues is increasing. Thus, these scholars concluded that there is a need to address green procurement, something that is neglected by conventional studies.

2.8.8 Corporate Social Responsibilities (CSR)

This criterion is composed of five sub-criteria: ethical behaviour; philanthropic responsibility; social sustainability; environmental sustainability; and economic sustainability. Xu et al. (2013) emphasised that because there has been an increase in global interdependence, CSR related to ethical, social and economic decisions is something that has to be considered in supplier selection. Similarly, Carter (2005) considered it as a corporate activity and its impact on different social groups.

In the framework of the current research, these sub-criteria are justified to be the ethical behaviour factor within the CSR dimension. Furthermore, the criteria in Xu et al. (2013) also included organisational legal responsibilities, pollution, and safeguarding mechanisms, which are a justification for the law and regulation factor within the CSR dimension in the present study. The idea of considering supply as part of the overall achievement of CSR is supported by Xu et al. (2013), who said that inefficiencies in a supply chain, such as wastage, can be detrimental to a company's operating costs. One of the main reasons for CSR to be important and included as a dimension in the framework of the current research is that companies expect their suppliers to be socially responsible. This is because they want to maintain their customers; in this sense, it could be detrimental in terms of reputation if an organisation's suppliers were insensitive to CSR issues.

Therefore, on one hand, the efficiency that can be derived from CSR, such as waste reduction or an efficient supply chain, has an impact on a company's profits, and on the other hand, the achievement of a positive reputation also has an impact on profit. Both are important justifications for considering CSR in supplier selection. Reputation is an important consideration for a company in terms of sales revenue and market. How a company handles CSR issues is important in determining the image and success of that company (Xu et al., 2013). Essentially, the pressures from stakeholders and customers make many companies committed to CSR.

Traditionally, in research about supplier selection, factors such as price, delivery, and quality have been considered. However, due to increased globalisation and the associated increase in competition, companies need to consider all factors to maximise profits. Large organisations include CSR in their supplier selection strategy, and suppliers are selected on the sole basis of their sustainability practices (Xu et al., 2013). The specific aspects of CSR that are factors in supplier selection can include human rights, labour, working hours, pollution, and legal responsibilities.

Organisations engage in philanthropy to show that they are being socially responsible and to raise their profile, with the real intention being to increase revenue. Although it would be difficult to determine sincere intentions in this case, it is important to understand that philanthropy is an important part of Arab culture, which derives from

the Islamic faith as something obligatory. A comparison between the UK and UAE cultures for this aspect of CSR is warranted.

In the above, environmental considerations have been discussed as one aspect of sustainability. Sustainability has received increased attention over recent years, and it is a crucial aspect of CSR. Supplier selection is an important part of making sure that supply chains are efficient and working towards achieving sustainability (Kumar et al., 2014). It is important to note that these selection criteria, as well as their associated sub-criteria, were examined in terms of their level of importance as selection criteria using the AHP technique, something that is applied in the current study for the same purposes.

2.8.9 Supplier Logistics Performance

This criterion comprises five sub-criteria: location; geographical distance; packaging; post-production configuration / ease of assembly; and hazardous goods management. Bala and Van Long (2005) and Knight et al. (2007) stated that the criterion and its sub-criteria are necessary to be considered in the supplier selection process. For instance, the right location is a step in a global sourcing strategy. Due to pressure from the competition, firms order materials and components from outside markets (Monczka et al., 2009) and this has led to a shift towards Low-Cost Country Sourcing (LCCS) (Timmermans, 2008). According to Timmermans (2008), Stalk (2006) and Bhutta and Huq (2002), LCCS does not mean cost alone, but is a multi-attribute approach that results in better location selection. Final decisions are based on how managers perceive different locations and the weight they give to different attributes (Bala & Van Long, 2005; Heragu et al., 2005; Knight et al., 2007; Sitkin & Weingart, 1995).

According to Teng and Jaramillo (2005), sourcing location selection is the first step in the supplier selection procedure, and it is considered to be a vital step. These authors explained that some of the significant factors that affect the supplier selection process are natural features of regions or countries, for example, market attractiveness, infrastructure and cost levels. The authors also explained that since suppliers within the same area share all the location-specific attributes, this avoids the need to rank these suppliers on those attributes and the selection decision for suppliers within the same area can be made directly after selecting the sourcing location.

Due to continuous pressure from the competition, there is a trend for companies to order products from other sources, including local markets. The right location is the first step in implementing a global sourcing strategy. It is not a firm decision, as the economic environment is changing. Industrial procurement managers need to continually re-evaluate locations and change supply from region to region, depending on the opportunities that arise. A good example in the current world was the crisis of global recession around 2008/09, which for several companies led to an increased pressure to reduce costs (Monczka et al., 2009). According to Timmermans (2008), there is evidence that managers have reacted by shifting towards LCCS. Bhutta and Huq (2002), Timmermans (2008) and Stalk (2006) explained that the integrated attribute framework leads to the selection of a more appropriate location, compared with a choice based on one factor, such as the cost of labour. Accordingly, Oboulhas et al. (2003) revealed that an effective supplier selection process should pursue stakeholders and values that address all areas and commitments pursued by subjective organisations.

The reliability of transportation means work ethics, the attractiveness of the market, intellectual property rights, etc. are all vital factors to take into consideration during supplier selection (Kouvelis & Niederhoff, 2007; Sarkis & Talluri, 2002). Final decisions are based on how managers perceive different locations and the weight they give to different attributes (Bala and Van Long, 2005; Heragu et al., 2005; Knight et al., 2007). Aspects that are critical to infrastructure, the attractiveness of the market, and the cost levels are features of countries or regions and not of vendors (Teng & Jaramillo, 2005).

According to Hsu and Hu (2009), hazardous goods management is a very important concept for any business organisation: restricted chemicals must have preventive management carried out by companies to treat the use of hazardous substances in production. Moreover, these scholars stated that documentation and regular inspection must be done for all the approaches used to track and screen faults and defects scientifically. These scholars noted that in each country or region, there are different regulations and policies for hazardous goods management, and the allowed concentration varies based on the materials needed.

2.9 Summary

To sum up this chapter, different theories were explained, as well as different selection criteria. Some of the relevant theories include the transaction cost theory (TCT), the institutionalisation theory and agency theory. Primarily, the review contends that TCT explains the increase in costs of operations when external parties are contracted to execute functions. In contrast, institutional theory delineates the supply chain as a component of the environment. Based on this contention, the internal and external structure of the institutional environment influences the nature of relationships they forge. As action-oriented structures, institutions are informed by the desire to achieve efficiency of operation in the long run and will therefore commit to actors or stakeholders who meet the demands of their environmental inclinations and priorities. Lastly, the chapter made an assessment of agency theory as an important resource in explaining the supplier selection process.

The chapter also made an assessment of the criteria that are conventionally considered in the identification of relevant suppliers in the UK and UAE. Relevant criteria included cost and price, quality, delivery and order fulfilment, experience / past performance, financial position, green practices, sustainability and corporate social responsibility. Other criteria include ethics and innovation. To realize the intended impact, it is necessary for institutions to apply evaluation methods. Some of the relevant supplier selection evaluation methods that were assessed include the Dickson's supplier selection criteria and the SOCCER supplier evaluation mode. In addition, since the research is concerned with the identification of cultural elements that affect relationships between suppliers, the chapter examined the various cultural factors and dimensions and their ultimate influences on relationships between suppliers within a given supply chain. From the analysis, it contends that internal and external structural elements do indeed affect the development and functioning of supply chains in the long run. To fully highlight the significance of the inferences in the theoretical section, the next chapter highlights the steps and actions that were taken to achieve findings on effective and sustainable supplier selection models.

CHAPTER 3: RESEARCH METHODOLOGY

To achieve the objectives of the current research, a mixed research method was used. Specifically, qualitative and quantitative research methods were used. According to Zou et al. (2014), mixed-method research enables the examination of the contradictions of an observed phenomenon. Seuring (2011) added that mixed-method research can be used to streamline the theory-building process. For instance, the study by Dubey et al. (2015) embraced mixed research methods in proving that it enhances the efficiency of the green supply chain management process.

For that research, the interview was used as its qualitative method and the questionnaire was used for the quantitative method. According to Kajornboon (2005), the interview method enables the collection of deeper insight as provided by the participant. The scholar explained that the method goes beyond the need to collect quantitative data and it gives a voice to the subjective experiences of the participant, which makes the findings more credible. Similarly, Tavakol and Sandars (2014) explained that the questionnaire ensures that different values are collected and established. These scholars explained further that this method facilitates generalisation.

In this chapter, the entire research process is presented. There is an overview of the qualitative and quantitative research methods and AHP. The details of the research participants are also presented.

3.1 Research Philosophy

The current study is based on the philosophy of immanence. This philosophy alludes to a theoretical framework that facilitates the examination of interactions between different actors in a defined network. In reflecting on the significance of the philosophy, Jackson and Mazzei (2013) argued that immanence facilitates the systematic review of structure and interactions which are found in given systems. These scholars also stated that based on this contention, the philosophy of immanence presupposes the existence of systems and guided interactions which lead to the order that is seen in an organisation.

Thus, the philosophy complements the current research because it facilitates the observation and assessment of the interactions that occur between different organisational players in a supply chain entity. Since the supply chain is made up of different players, it is necessary to determine the roles and exchanges that are overseen in the setting and how they complement functionality as observed within the institution. The philosophy of immanence encourages flexibility in the collection of relevant data, which is necessary for the current study given its extensive nature.

3.2 Research Design

According to Saunders et al. (2007), a research design is an overall strategy that the researcher plans to use to answer the research questions. In the research design, the research methodology should be defined, and the industry, location, and analysis of selected data should be clearly stated. Saunders et al. (2007) and Yin (2002) stated that the research design should be prepared before starting the data collection. These scholars also stated that researchers should clarify and explain the nature of the data to be collected, the method of data collection and the source of these data.

Hair et al. (2010) also stated that at a later stage, researchers need to clarify the method of data analysis and the procedure for answering the research questions using this approach to data analysis. In a nutshell, Hair et al. (2010) sum up by stating that the research design is the basic guidelines for completing the research.

In respect to the above scholars, the current research employed a mixed research design. It used both qualitative and quantitative methods. According to the Priority-Sequence model developed by Morgan (1998), the mixed-method research design is a combination of qualitative and quantitative methods. This approach prioritises one of the two methods as the principal method. Thereafter, the sequence of the complementary method is defined.

Thus, to select the best method for the study, the researchers need to decide which method will be the principal method (qualitative or quantitative). Based on Morgan's (1998) sequence, there are four basic research designs: (a) preliminary qualitative methods in a quantitative study; (b) preliminary quantitative methods in a qualitative study; (c) follow-up qualitative methods in a quantitative study; and (d) follow-up

quantitative methods in a qualitative study. The details of Morgan's sequence are presented in Figure 3.1.

	Priority Decision	
	Principal Method: ***Quantitative***	Principal Method: ***Qualitative***
Complementary Method: ***Preliminary***	**1. Qualitative Preliminary** **qual ➔ QUANT** **Purposes:** Smaller qualitative study helps guide the data collection in a principally quantitative study. ○ Can generate hypotheses, develop content for questionnaires and interventions, etc. **Example:** Focus groups help to develop culturally sensitive versions of anew health promotion campaign.	**2. Quantitative Preliminary** **quant ➔ QUAL** **Purposes:** Smaller quantitative study helps guide the data collection in the principally qualitative study. ○ Can guide purposive sampling establish preliminary results to pursue in depth etc. **Example:** A survey of different units in a hospital locates sites for more extensive ethnographic data collection.
Sequence Decision		
Complementary Method: ***Follow-up***	**3. Qualitative Follow-up** **QUANT➔ qual** **Purposes:** smaller qualitative study helps evaluate and interpret results from a principally quantitative study. ○ Can provide interpretations for poorly understood results, help explain outliers, etc. **Example:** In-depth interviews help to explain why one clinic generates higher levels of patient satisfaction.	**4. Quantitative Follow-up** **QUAL➔ quant** **Purposes:** smaller quantitative study helps evaluate and interpret results from a principally qualitative study. ○ Can generalize results to different samples, test elements of emergent theories, etc. **Example:** A statewide survey of a school- based health program pursues earlier results from a case study.

Figure 3.1 Priority-Sequence Model (Adopted from Morgan's,1998)

Based on the above figure, the research approach of the current research corresponds to Morgan's (1998) cell number two strategy (that is, preliminary quantitative methods in a qualitative study). Similarly, Zikmund (2003) suggested that researchers should start first with the qualitative research to gain a clear understanding of and to explore the studied case.

In respect to Morgan's approach and Zikmund (2003), the researcher of the current research started with the qualitative research purposely to know the subjective dimensions of the supplier selection criteria. The researcher regarded the qualitative method as her 'principal method' and complemented it with AHP quantitative measures. This approach was employed so that a decision regarding the weights of each criterion and the sub-criteria of the current research's framework.

3.2.1 Qualitative Approach

To solve the research questions in a qualitative study, there are always 'what', 'how' and 'why' questions. These questions require the collection of qualitative data rather than quantitative data. This type of data contains free-form text questionnaire answers and recorded interviews (Ritchie et al., 2003). According to Yilmaz (2013), participant observation, in-depth interviews, focus groups, and document analysis are used in the data collection and analysis of qualitative studies.

Moreover, Barnham (2015) stated that open-ended questions, framing, projective methods, and mapping exercises can be applied as techniques in qualitative studies. Yin (2002) outlined that the research design ought to be diverse to ensure the gathering of a wide range of evidence that can be used to validate the identified inferences. The current research used interviews with a few companies that could be described as cases. These cases are from the two specific locations – the UK and UAE. This approach is supported by Voss (2010), who stated that it reinforces the accuracy of the collected data to augment the efficiency of the findings.

The interview process is always geared towards the collection of qualitative information according to Kajornboon (2005). Consequently, the current research collected data regarding the different criteria and the cultural elements that are considered to be the key influencing factors for selecting suppliers in the UK and UAE. The interviews in the

current research had two phases. The first phase was UK interviews and second was UAE interviews. Altogether, there were 100 interviews. The interviewees are also questionnaire respondents, because the interviews were conducted first before the respondents were requested to fill in the questionnaire. Thus, the interviewees and respondents are called 'participants' in this research. The details of the participants are presented in subsection 3.3.

The duration of each interview was more than an hour. The interviews were conducted within a seven-month period. The participants were given time to schedule a suitable date and venue for the interviews. All interviews were conducted in person to ensure that accurate information and correct interpretations were made, as suggested by Oishi (2003). Similarly, one to two interviews were conducted per day.

To ensure that compelling insight was collected, the current research used closed-ended questions with enough space for additional information. This is in line with the philosophy of immanence that demanded that the collection of insight needs to transcend a limited scope as well as inform the researcher's background. Fricker and Schonlau (2002) stated that the closed-ended questions were meant to allow the researchers to have an in-depth understanding of the interviewees' knowledge. Furthermore, given that the current research is on cultural dynamics, the researcher sought to provide the interviewees with the opportunity to address issues based on their qualitative values. Handfield and Nichols Jr. (1999) said that this initiative would facilitate the identification of the role of each stakeholder in the supply chain management process.

The interviews were recorded, and the consent of the participants was sought. Similarly, confidentiality was duly discussed with the participants. A tape recorder was used. All recorded interviews were transcribed by the researcher. Likewise, the recordings were listened to several times by the current researcher. The transcriptions were used for analysis.

3.2.2 Quantitative Approach

Quantitative studies are generally interested in testing why and how phenomena can differ. However, this 'why and how' is different from the 'why and how' in qualitative

studies. Statistics and mathematical models are used in quantitative studies for data analysis. Additionally, in quantitative studies, the results explain relationships and provide categorical answers such as satisfactory, good, bad or excellent relationships, without quantifying these relationships (Tavakol & Sandars, 2014).

Primary quantitative data were collected by the current researcher for the quantitative part. According to Tayur et al. (2012), to provide the best answer for a quantitative study, a clear expression should be ensured in the collected data. Hence, the researcher had an interest in finding out about different kinds of relationship among the proposed key criteria (outlined in the theoretical framework). For instance, the current researcher examined a positive/negative relationship among the criteria of quality, price, and delivery. This approach is in line with the explanations of Brandenburg et al. (2014), who stated that the magnitude of the relationships between the variables needs to be established in the quantitative studies.

AHP was used in the current research as its main quantitative instrument. The application of the AHP method was selected to provide a ranked list of the chosen criteria. The AHP method is widely used for similar studies of supplier selection, such as Radivojević and Gajović (2014), Bhagwat and Sharma (2009) and Gaudenzi and Borghesi (2006), and AHP is one of the MCDM methods that is used for making complex decisions.

It structures decision-making problems in a hierarchical model consisting of quantifiable components with their relationships and the alternatives, to achieve a specific target (Saaty, 1980). One of the most important advantages of AHP is that it enables researchers to measure the results of the study more effectively and thus deliver an appropriate scale of ranking for the criteria (Lirn et al., 2004). AHP helps to convert the criteria from qualitative to quantitative data for more accurate and simpler measurement and analysis.

3.3 Research Participants

There are 100 participants in the current research, specifically, 50 participants from each country case study. These participants represented the stakeholders relevant to supplier selection in the supply chain of the construction industry. They consist of Chief

Executive Officers (CEOs) / presidents of the company, purchasing managers, supply chain supervisors, operational managers and other stakeholders in the construction industry. They are working in construction companies in the UK and UAE. The details are presented below:

(a) The UK Participants

They held managerial positions in the company (during the period of interviewing and filling in the questionnaires). They are purchasing managers (21), supply chain managers (9), presidents/CEOs (3), operation managers (11), and logistics managers (6). Their positions showed that these participants represent important decision makers for supplier selection. Similarly, the majority of these participants (the purchasing, supply chain, and operation managers) usually have a close relationship with the suppliers, as explained by Pienaar (2009), Kannan and Tan (2006) and Tracey and Chong (2001).

These participants have substantial working experience. For instance, almost half of them (46%) had worked in their jobs for 7–10 years and 28% had remained in their jobs for more than 10 years. Similarly, 22% of them had held their position in the company for 3–6 years. Only, two participants had worked in their current positions for less than three years (4%). In terms of qualifications, the majority of the participants possessed higher degrees; 56% held master's or Ph.D. degrees and 44% held bachelor's degrees. In terms of age, most of them were 41–50 years old (38%) or above 51 years old (34%). A small number of the participants (28%) were under 40. Gender wise, 54% of them were males, while the rest (46%) were females.

Besides, most participants work in large corporations. The majority of the companies (60%) had more than 1,500 employees; 26% had 1,001–1,500 employees, and a small number of the companies had 501–1,000 employees (7%). In terms of age, 40% of the companies were 3–6 years old and 34% were 7–10 years old. Eleven companies were more than 10 years old (22%) and only two companies (4%) were less than three years old.

(b) The UAE Participants

Similar to the participants from the UK, there were 18 purchasing managers, 11 supply chain managers, a president/CEO, 14 operation managers, and six logistics managers. The largest group of participants had held their position for 3–6 years (44%). The second largest group had held their position for 7–10 years (28%) and 22% had remained in their jobs for more than 10 years. Only 6% of the respondents had been working in their current positions for less than three years. Furthermore, the majority of the participants, 62%, held bachelor's degrees, while 38% of them held master's and Ph.D. degrees. Most of the participants were between 41 and 50 years old (48%), while 32% were between 30 and 40 years old. A small number of participants were above 51 years old (20%). Unlike the UK, where gender is almost equal, the participants from the UAE were mainly men (86%), with only 14% females.

Regarding the participants' companies, 44% of the companies had had 1,001–1,500 employees, 40% of the companies had more than 1,500 employees, and only 16% had 501–1,000 employees. Most of the participating companies were aged 3–6 years (44%), 30% were 7–10 years old, 18% were more than 10 years old, and only 8% of companies were aged less than 3 years. The following table shows the details.

Table 3.1 The Details of Research Participants

Participants' details	**The UK**	**The UAE**
Position		
Purchasing managers	21	18
Supply chain managers	9	11
Presidents/CEOs	3	1
Operation managers	11	14
Logistics managers	6	6
Total number of participants	**50**	**50**
Job Duration		
Less than three years	2	3
3–6 years	11	22
7–10 years	23	14

More than 10 years	14	11
Total number of participants	**50**	**50**
Qualification		
Bachelors	14	31
Master's/Ph.D.	36	19
Total number of participants	**50**	**50**
Age		
30–40 years	14	16
41–50 years	19	24
More than 51 years	17	10
Total number of participants	**50**	**50**
Gender		
Male	27	43
Female	23	7
Total number of participants	**50**	**50**
Company's size		
501–1,000	7	8
1,001–1,500	13	22
More than 1,500	30	20
Total number of participants	**50**	**50**
Company's age		
Less than 3 years	2	4
3-–6 years	20	22
7-–10 years	17	15
More than 10 years	11	9
Total number of participants	**50**	**50**

3.4 The Research Process

This research consisted of six main phases as shown in Figure 3.2. The phases were interlinked. Each phase took several months. These phases were necessary steps to achieve the objectives of the current research. They are summarised below:

(a) Literature Review: This was the first step. At this phase, there was an extensive review of the literature. Different types of scholarly works were reviewed, including articles, books and book chapters, and conference proceedings. Similarly, some non-academic materials were studied, such as reports, online news, and magazines. This phase enabled the researcher to familiarise herself with the current research topic, as well as to understand the underpinning theories and models of the topic. The main outcome of the phase was the development of research questions and goals.

(b) Framework Development: The outcome of the first phase enabled the researcher to select the relevant theories and theoretical framework for her work. Hence, at this phase, different selection criteria and models were analysed. The selected criteria were arranged in a hierarchical structure comprising main criteria and sub-criteria. The arrangement of the criteria and sub-criteria was undertaken by experts within the field of supply chain management and by professional academics. The research framework was then developed to fit with the AHP hierarchical structure, as shown in Chapter 2.

(c) Interview Questions and Questionnaire Development: Based on the research goals, questions, and framework, a research methodology was selected at this phase. The methodology was compared with previous similar studies. This phase also considered philosophy, research methods, and research instruments. Similarly, a list of interview and questionnaire questions was developed. The interview questions were closed-ended and limited to information relating to the research. The questionnaire contained two main parts. The first collects demographic information and the second contains the criteria and sub-criteria.

These questions were made to fulfil pairwise comparisons (to be suitable for AHP analysis). Moreover, the questions contain other sections to highlight the main purpose of the current study and an example to explain how to answer the survey questions was given, as according to Rattray and Jones (2007) and Finset et al. (2002). There

was a section on demographics to obtain additional data about the participants, as recommended by Moore and Moyer (2002). The interview questions and questionnaires were sent via email and also presented in person to achieve more accurate and efficient results.

The questionnaire and interviews were tested by the experts and professional academics before their distribution. This test was termed a pilot questionnaire. A few experts from two construction companies in Abu Dhabi (UAE) and two professors from United Arab Emirates University (UAEU) were invited to participate in the pilot survey. The results of this pilot survey demanded a revision of the questions, some word changes (to clearer synonyms), very minor modifications to the questionnaire's sections, and a slight change to the format.

All their recommendations and comments were applied to the study questionnaire for improvement. The revisions were made by educational experts, whose experience informed the identification of questions that were more critical and appropriate for the exercise. From this pilot interview, 10 questions were updated, and some language was edited. The time needed to complete each interview was calculated.

(d) Data Collection: After the interview questions and questionnaire were validated, a list of construction companies in the UK and UAE was compiled. These companies were privately and semi-government owned businesses with more than 500 employees. The companies were involved in mega projects in their country. From each company, the details of 5–6 employees in managerial positions were listed (phone numbers and email addresses). After that, all the targeted respondents were contacted by phone and email to ensure that they had no objection to participating in this research before conducting the full personal interviews. About 300 construction companies in the UK and UAE were contacted.

The responding companies (their managers) were asked to propose a date, time and venue for the interview. During the interview schedule, the questionnaire was also discussed. It was agreed that the questionnaire would be filled in by the participants on the same day. The reason for filling in the questionnaire at the same time as the interview was that it is difficult to obtain adequate responses by online survey

distribution because of the volume of selection criteria, and also to ensure that the participant responded to the questionnaire in a timely manner.

(e) Data Analysis: There were two types of data – the qualitative and quantitative data. The qualitative data were analysed with thematic analysis. Braun and Clarke (2006) and Eriksson and Kovalainen (2008) stated that thematic analysis enables researchers to get an in-depth insight into a phenomenon. Thus, the current research employed it. According to Braun and Clarke (2006), thematic analysis has six steps.

The steps are familiarisation with collected data, generation of code, identification of themes from the codes, reviewing of themes, renaming of themes, and reporting of results. All these steps were followed in the current research. The main themes that were focused on during the analysis were the most important selection criteria and their sub-criteria, and the cultural influences on decision-making.

The quantitative analysis was done with the AHP concept and Analysis of Variance (ANOVA). AHP was used purposely to enable pairwise comparisons of the criteria and ANOVA was used to compare results between the UK and UAE. These comparisons aimed to reveal the similarities and differences between the decisions taken by the UK and UAE participants in selecting their suppliers.

(f) Development of Mathematical Model: The analysis of the quantitative data demanded the creation of the mathematical formula that would be used to facilitate the identification and selection of the best supplier. The development of the model was done at this phase. The outputs of the AHP were used in the mathematical formula; these are the weights of the selection criteria available in the current research framework.

The details of AHP in the current research are explained in the next subsection. Similarly, pairwise is explained. The model will be useful for companies in the future. The importance of this model is to systemise the decision-making and ensure quick decision-making. Moreover, this model enhances the supplier selection decision process and adds a new technique for supplier evaluation based on an established formula.

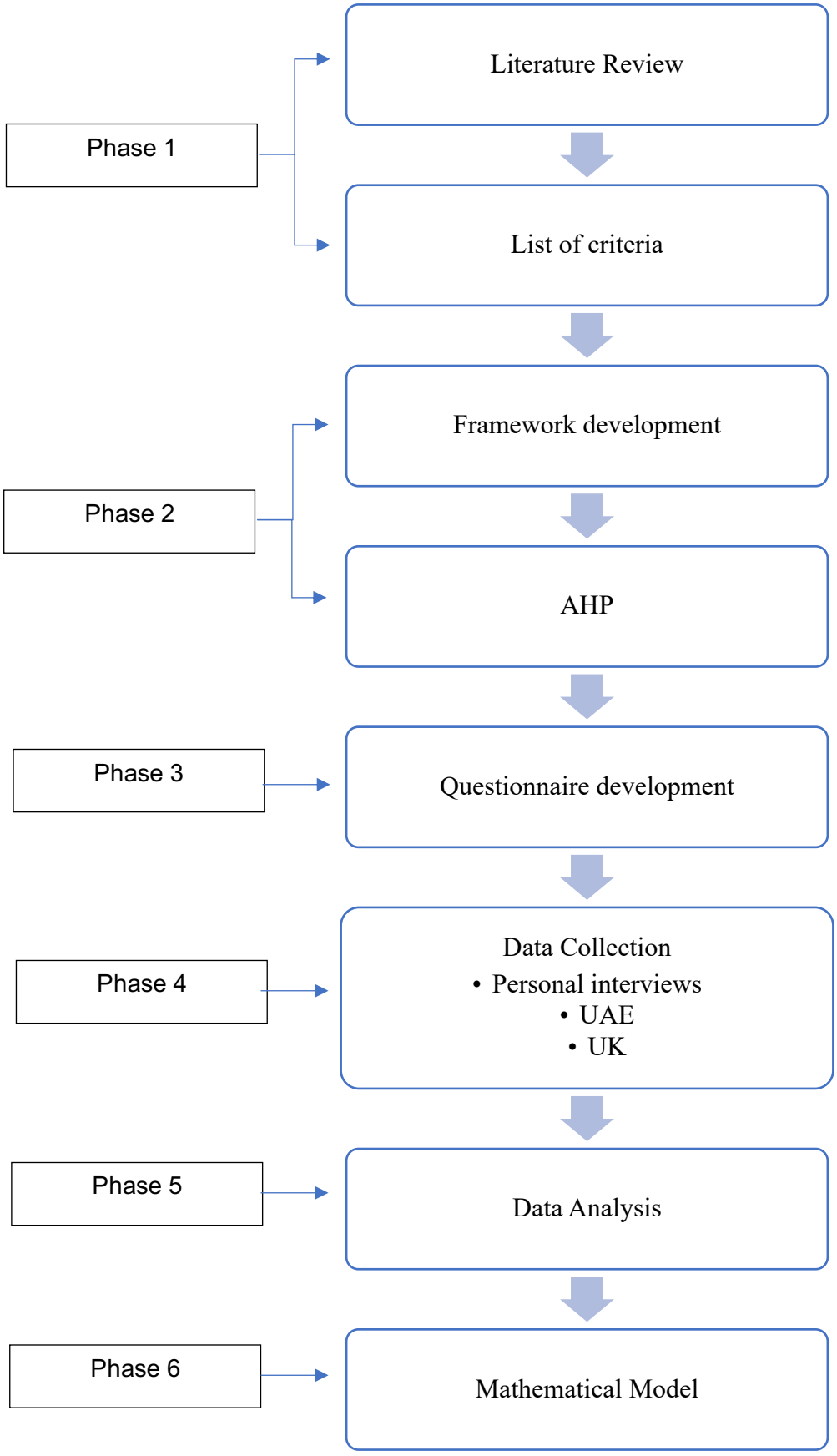


Figure 3.2 Flowchart of the Research Process

3.5 The Analytic Hierarchy Process (AHP) and Development of the Current Research Mathematical Model

Yahya and Kingsman (1999) examined different methods for decision-making problems and from the analyses in their study, they found that the AHP method is more practical and flexible than any other method for solving complex decision-making problems. Due to the complexity of the current world system, Wong and Li (2008) stated that there is a need to arrange priorities to be able to deal with unstructured and complex problems/systems and to have a clear agreement that one objective exceeds another in its importance.

Such complexity is further compounded by the frequent regulatory and policy changes that may ultimately impede sustained interactions between interfirm agencies and the work to negate the determined relationships between different actors (Wang et al., 2016). Bayazit and Karpak (2005) also stated that it is necessary to employ a trade-off to support common concerns and the main objectives. However, Bayazit and Karpak (2005) noted that it is often difficult to indicate which objective exceeds another in importance and to arrive at the best solution for complex problems, because a large margin of error can be accrued in formulating the trade-offs.

AHP is a powerful method for solving decision-making problems, which considers the proportionality of many factors and alternatives used in selection decisions. Moreover, AHP can handle intuitive, logical and illogical circumstances when making decisions. Deductive and inductive evaluation can be conducted using the AHP methodology, which allows the consideration of numerous factors and alternatives with the advantage of a response mechanism and trade-offs at the same time (Albayrak & Erensal, 2004).

According to Saaty (1980), there are four main phases for applying AHP: (1) forming a hierarchy; (2) pairwise comparisons; (3) priority vector generation; and (4) synthesis. Similarly, Bello (2003) stated that there are five main steps for applying the AHP method to the supplier selection problem. These steps are briefly explained below:

(1) Identify the criteria that can be used as evaluators for supplier selection purposes, then rearrange the decision problem factors into a hierarchical representation.

(2) Create the pairwise comparisons of the criteria relative to their importance to achieving the research objective; calculate the weights of the criteria based on these data to prioritise them.
(3) Test the degree to which each supplier meets the selection criteria. Then, check the satisfaction with the input data, then commit the data to the test of consistency to ensure that they reflect a systemic pattern. If the consistency test is not satisfied, repeat the pairwise comparisons.
(4) From the information in the previous step (step 3), produce pairwise comparisons of the suppliers, respecting the criteria relative to their importance, and calculate the equivalent priorities.
(5) From the outcomes of steps 2 and 4, by incorporating the priority for all vectors, the final priority vector of each supplier is acquired to fulfil the target of the research hierarchy.

Furthermore, Saaty (1990) stated that AHP offers a special representation in the form of a hierarchy that contains different levels. The scholar explained that the first level presents the main criteria, the second level is the sub-criteria and the final level is the alternatives. The scholar explained further that a matrix can be created through an arrangement of pairwise comparisons at different levels of the hierarchy.

With respect to the above processes, the current research started AHP by establishing hierarchies. The first hierarchy derived the overall objective of the research. Then, the next level in the hierarchy contained the main criteria and the hierarchy descended to the sub-criteria and so on, until the lowest level in the hierarchy was established. According to Saaty (1980, 1990) and Bello (2003), there is no specific rule or standard for constructing a hierarchy. Meanwhile, these scholars stated that using AHP, the complex decision-making problem is rearranged in a way that all the important factors and alternatives are listed first; they are then arranged in a hierarchy to conduct a comparison of the factors of the lower levels with some or all of the factors in the next level up.

Saaty (1990) explained that one of the advantages of AHP is that it is a creative method that enables the decision maker to simplify the problem by splitting it into basic elements consisting of the overall goal, the criteria, and the alternatives. This arrangement allows large quantities of data to be incorporated into the problem

structure, thus building up a complete system for the decision-making problem. Figure 3.3 shows the AHP structure.

The structure of the AHP hierarchy starts with the main objective of the decision at the top level, the main criteria at the second level, the sub-criteria (if any) at the third level and the decision alternatives at the last level of the hierarchy. Moreover, there is no specific technique to generate the levels of the hierarchy; it all depends on the specific decision-making problem. Furthermore, creative thinking and people's viewpoints can be used to construct the AHP hierarchy (Saaty, 2001).

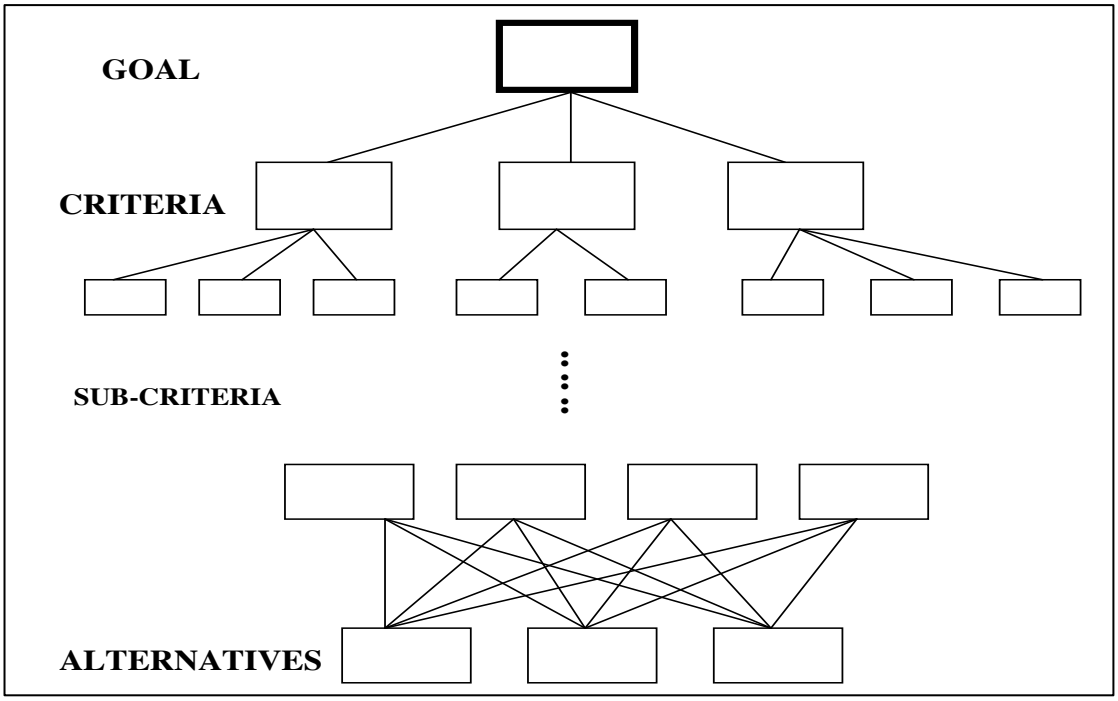


Figure 3.3 General Guidelines for Constructing Hierarchy (Adopted from Chan & Chan, 2004)

The nature of the AHP hierarchy makes the structure flexible enough to be adapted or changed as required to include new elements or criteria that were not included when establishing the hierarchy. In general, the person's experience and their understanding of the subject control the overall AHP hierarchy. Based on that, they can select what is to be included and where to include it in the hierarchy.

All relative details must be included when establishing an AHP hierarchy. The decision problem must be presented as systematically and as completely as possible. Similarly, the surrounding environment of the problem must be considered. Likewise, identifying

the attributes that contribute to the solution and the contributors related to the problem are important steps in developing an AHP hierarchy (Saaty, 1980, 1990, 1996). The AHP hierarchy of the current research is shown in the following figure.

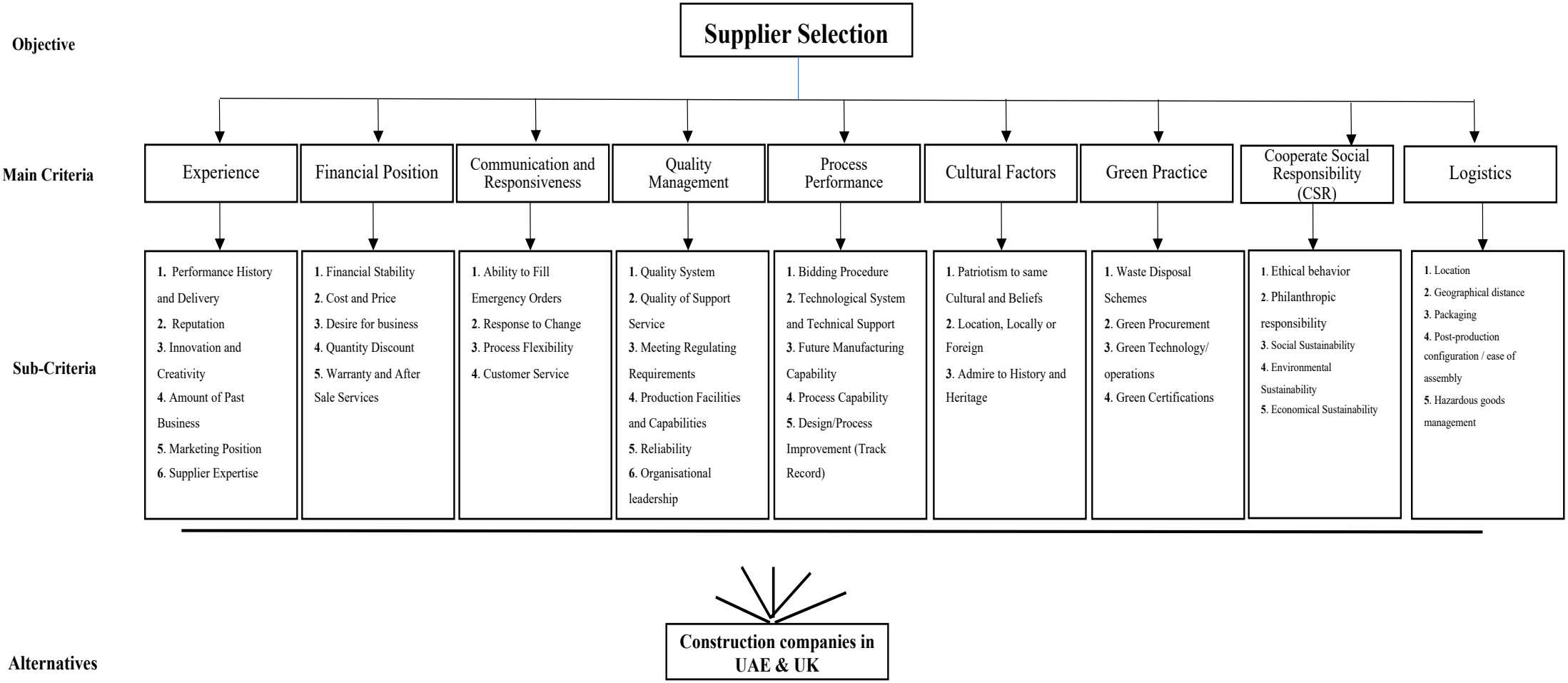


Figure 3.4 The Current Research Hierarchy

After creating the above AHP hierarchy, the questionnaire based on pairwise comparisons was developed. As presented before, the final AHP hierarchy for the current study includes nine main criteria and 44 sub-criteria. The questionnaire, therefore, contains a table for the comparison of the main criteria and nine tables for the sub-criteria. Moreover, the questionnaire and interview questions contained other sections to highlight the main purpose of the current study and an example to explain how to answer the survey questions, as recommended by Rattray and Jones (2007) and Finset et al. (2002).

According to Bello (2003) and Saaty (1980, 1990), once the hierarchy is structured, the next step is to conduct a pairwise comparison to compare the elements in pairs against a given criterion. A set of comparison matrices of all the elements in a level of the hierarchy for an element of the level immediately higher is constructed to prioritise and convert individual comparative judgements into ratio scale measurements. The preferences are quantified by using a nine-point scale.

In the current research questionnaire, the objective was to establish the relative importance of the different criteria which affect different decision makers in their supplier selection. In doing so, the decision makers (the research participants) were asked to give a pairwise intensity of importance number, which reflects the relative importance of any two criteria or sub-criteria. The different intensities of importance are shown in the pairwise comparison scale in Table 3.2 below, with a specific explanation of each intensity.

Table 3.2 The Scale of Preference between Two Elements (Adopted from Saaty, 1996)

The Pairwise Comparison Scale		
Importance Intensity Number	Importance Intensity Name	Description
1	Equal Importance	The two criteria contribute equally to the decision
3	Moderate Importance	Slightly favour one criterion over the other
5	Strong Importance	Strongly favour one criterion over the other
7	Very Strong Importance	Very strongly favour one criterion over the other
9	Extreme Importance	Extremely favour one criterion over the other
You can also assign 2, 4, 6, and 8 to express intermediate values.		

Following the above scale for pairwise comparison, the decision makers were asked to fill in the questionnaire tables with their preferences for the relative importance of the different criteria and sub-criteria that affected their choice of supplier (Appendix A). The current research survey consisted of 10 comparison tables – one for the main selection criteria and nine tables for the sub-criteria. Because the current research was conducted in different places, it gave the ability to have a clear vision about the effects of the decision makers in each country in their supplier selection decision.

Meanwhile, Saaty (1980) noted that there is a possibility that there would be differences between the comparison results and the decision during the pairwise comparison process. The scholar said that AHP requires an inconsistency ratio, which is defined as the degree of consistency of the judgement of the decision maker. Therefore, the consistency is determined by using the Eigenvalue, λmax, and by computing the consistency index (CI). According to Saaty (1980), the CI is calculated after finishing the AHP matrix, using the following equation:

$$CI = (\lambda_{max} - n) / (n - 1) \quad (3.1)$$

where λ_{max} is the maximum Eigenvalue of the matrix and n is the number of criteria in the model (matrix size).

The CI value is compared with the same index obtained as an average over many mutual matrices of the same order that were entered randomly. After the CI, the consistency ratio (CR) is calculated to check the matrix's consistency using the following equation:

$$CR = CI / RI \quad (3.2)$$

where RI is the random index shown in Table 3.3.

Table 3.3 The Random Index (Adopted from Saaty, 1980)

N	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.48

According to Saaty (1980), the accepted value for the CR is less than 10%. If the CR is greater than 10% then the consistency of the data collection result is not

accepted, and the judgement matrix is considered to be inconsistent. Therefore, any results collected in this research with CR greater than 10% were removed before proceeding with the analysis. In the current research, consistency is enhanced by examining and repeating the judgements.

Besides the above process, the priority vectors were computed to describe the relative priorities of the criteria. According to Saaty (1990), the priority vectors are calculated by 'consistency principle', by applying the following formulas:

$$a_{ik} = a_{ij} . a_{jk} \tag{3.3}$$

where a_{ij} represents the importance of alternative $_i$ over alternative $_j$ and a_{jk} represents the importance of alternative $_j$ over alternative $_k$. So, a_{ik}, is the importance of alternative $_i$ over alternative $_k$,

and

$$\boldsymbol{a_{ij} = w_i / w_j} \tag{3.4}$$

where w_i and w_j are the weights of the criteria *i* and *j* respectively.

Checking the consistency of the judgement is considered an advantage of the AHP method. As it is done before taking the final decision, this helps the decision makers to test and improve their judgements. Finally, the discussed steps of the AHP process must be carried out for all levels of the hierarchal structure.

After finding the weights of each criterion and the sub-criteria using the AHP concept, and the score of each supplier in each criterion or the sub-criteria using decision maker judgements (which depend on the company's needs and also the position of the decision maker in the organisation), the overall score of each supplier was calculated. According to Saaty (1980), the total score of the criteria and sub-criteria can be obtained using the following mathematical model:

$$(\boldsymbol{W_1 \times S_1}) + (\boldsymbol{W_2 \times S_2}) + (\boldsymbol{W_3 \times S_3}) + \cdots (\boldsymbol{W_n \times S_n}) \tag{3.5}$$

where:

$\boldsymbol{W}$ is the weight of the criterion,

$\boldsymbol{S}$ is the score of each alternative in the criteria,

$\boldsymbol{n}$ is the number of criteria available in the model.

Accordingly, from the current research framework, the number of main criteria is nine and the number of sub-criteria is 44. Thus, the following mathematical formulation (Equation 3.6) is developed to calculate a supplier's total score for the current research framework:

Overall Supplier Score =

$$\{\boldsymbol{W_1} \times [(\boldsymbol{W_{11}} \times \boldsymbol{S_{11}}) + (\boldsymbol{W_{12}} \times \boldsymbol{S_{12}}) + (\boldsymbol{W_{13}} \times \boldsymbol{S_{13}}) + (\boldsymbol{W_{14}} \times \boldsymbol{S_{14}}) + (\boldsymbol{W_{15}} \times \boldsymbol{S_{15}}) + (\boldsymbol{W_{16}} \times \boldsymbol{S_{16}})]\} + \{\boldsymbol{W_2} \times [(\boldsymbol{W_{21}} \times \boldsymbol{S_{21}}) + (\boldsymbol{W_{22}} \times \boldsymbol{S_{22}}) + (\boldsymbol{W_{23}} \times \boldsymbol{S_{23}}) + (\boldsymbol{W_{24}} \times \boldsymbol{S_{24}}) + (\boldsymbol{W_{25}} \times \boldsymbol{S_{25}})]\} + \{\boldsymbol{W_3} \times [(\boldsymbol{W_{31}} \times \boldsymbol{S_{31}}) + (\boldsymbol{W_{32}} \times \boldsymbol{S_{32}}) + (\boldsymbol{W_{33}} \times \boldsymbol{S_{33}}) + (\boldsymbol{W_{34}} \times \boldsymbol{S_{34}})]\} + \{\boldsymbol{W_4} \times [(\boldsymbol{W_{41}} \times \boldsymbol{S_{41}}) + (\boldsymbol{W_{42}} \times \boldsymbol{S_{42}}) + (\boldsymbol{W_{43}} \times \boldsymbol{S_{43}}) + (\boldsymbol{W_{44}} \times \boldsymbol{S_{44}}) + (\boldsymbol{W_{45}} \times \boldsymbol{S_{45}}) + (\boldsymbol{W_{46}} \times \boldsymbol{S_{46}})]\} + \{\boldsymbol{W_5} \times [(\boldsymbol{W_{51}} \times \boldsymbol{S_{51}}) + (\boldsymbol{W_{52}} \times \boldsymbol{S_{52}}) + (\boldsymbol{W_{53}} \times \boldsymbol{S_{53}}) + (\boldsymbol{W_{54}} \times \boldsymbol{S_{54}}) + (\boldsymbol{W_{55}} \times \boldsymbol{S_{55}}) + (\boldsymbol{W_{56}} \times \boldsymbol{S_{56}})]\} + \{\boldsymbol{W_6} \times [(\boldsymbol{W_{61}} \times \boldsymbol{S_{61}}) + (\boldsymbol{W_{62}} \times \boldsymbol{S_{62}}) + (\boldsymbol{W_{63}} \times \boldsymbol{S_{63}})]\} + \{\boldsymbol{W_7} \times [(\boldsymbol{W_{71}} \times \boldsymbol{S_{71}}) + (\boldsymbol{W_{72}} \times \boldsymbol{S_{72}}) + (\boldsymbol{W_{73}} \times \boldsymbol{S_{73}}) + (\boldsymbol{W_{74}} \times \boldsymbol{S_{74}})]\} + \{\boldsymbol{W_8} \times [(\boldsymbol{W_{81}} \times \boldsymbol{S_{81}}) + (\boldsymbol{W_{82}} \times \mathbf{S_{82}}) + (\mathbf{W_{83}} \times \mathbf{S_{83}}) + (\mathbf{W_{84}} \times \mathbf{S_{84}}) + (\mathbf{W_{85}} \times \mathbf{S_{85}})]\} + \{\mathbf{W_9} \times [(\mathbf{W_{91}} \times \mathbf{S_{91}}) + (\mathbf{W_{92}} \times \mathbf{S_{92}}) + (\mathbf{W_{93}} \times \mathbf{S_{93}}) + (\mathbf{W_{94}} \times \mathbf{S_{94}}) + (\mathbf{W_{95}} \times \mathbf{S_{95}})]\} \quad (3.6)$$

where:

W_i is the weight of the i^{th} criteria,

W_{ij} is the relative weight of the sub-criteria j of the criteria i, and

S_{ij} is the score of each supplier in the sub-criteria j of the criteria i.

To apply the above equation (Equation 3.6), the pairwise comparison results available in Appendix B are used. Tables 3.4 and 3.5 present W_i and $W_{ij,}$ which

are the weights achieved from the AHP for both the UAE and the UK. The scores (S_{ij}) depend on the decision maker's judgements and needs, for example, if a criterion or a sub-criterion is important to the decision makers, they will give it a high score during the evaluation process and vice versa.

Table 3.4 The Weights of the Main Criteria and Sub-criteria for the UK Respondents (AHP Outputs)

Main Criteria	Weight	Sub Criteria	Weight
Supplier Experience **(W1)**	0.04	Performance History & Delivery **(W11)**	0.07
		Reputation **(W12)**	0.06
		Innovation & Creativity **(W13)**	0.18
		Amount of Past Business **(W14)**	0.04
		Marketing Position **(W15)**	0.42
		Supplier Expertise **(W16)**	0.23
Supplier Financial Position **(W2)**	0.09	Financial Stability **(W21)**	0.22
		Cost and Price **(W22)**	0.15
		Desire for Business **(W23)**	0.10
		Quantity Discount **(W24)**	0.05
		Warranty & aftersales services **(W25)**	0.47
Communication & Responsiveness **(W3)**	0.07	Ability to Fill Emergency Orders **(W31)**	0.35
		Response to Change **(W32)**	0.13
		Process Flexibility **(W33)**	0.23
		Customer Service **(W34)**	0.29
Quality Management **(W4)**	0.25	Quality System **(W41)**	0.27
		Quality of Support Service **(W42)**	0.20
		Meeting Regulatory Requirements **(W43)**	0.26
		Production Facilities and Capabilities **(W44)**	0.16
		Reliability **(W45)**	0.04
		Organisational Leadership **(W46)**	0.08

Process Performance **(W5)**	0.02	Bidding Procedure **(W51)**	0.08
		Technological system and technical support **(W52)**	0.27
		Future Manufacturing Capability **(W53)**	0.07
		Process Capability **(W54)**	0.25
		Design/process improvement **(W55)**	0.34
Supplier Cultural Factors **(W6)**	0.06	Patriotism to same Cultural and Beliefs **(W61)**	0.23
		Location, Local or Foreign **(W62)**	0.67
		Admire History and Heritage **(W63)**	0.10
Supplier Green Practices **(W7)**	0.14	Waste Disposal Schemes **(W71)**	0.11
		Green Procurement **(W72)**	0.52
		Green Technology/ operations **(W73)**	0.32
		Green Certifications **(W74)**	0.05
CSR **(W8)**	0.09	Ethical behaviour **(W81)**	0.24
		Philanthropic responsibility **(W82)**	0.14
		Social Sustainability **(W83)**	0.10
		Environmental Sustainability **(W84)**	0.19
		Economic Sustainability **(W85)**	0.33
Supplier Logistics Performance **(W9)**	0.23	Location **(W91)**	0.33
		Geographical distance **(W92)**	0.06
		Packaging **(W93)**	0.09
		Post-production configuration / ease of assembly **(W94)**	0.19
		Hazardous goods management **(W95)**	0.34

Table 3.5 The Weights of the Main Criteria and Sub-criteria for the UAE Respondents (AHP Outputs)

Main Criteria	Weight	Sub Criteria	Weight
Supplier Experience **(W1)**	0.12	Performance History & Delivery **(W11)**	0.25
		Reputation **(W12)**	0.20
		Innovation & Creativity **(W13)**	0.17
		Amount of Past Business **(W14)**	0.12
		Marketing Position **(W15)**	0.13
		Supplier Expertise **(W16)**	0.14
Supplier Financial Position **(W2)**	0.12	Financial Stability **(W21)**	0.30
		Cost and Price **(W22)**	0.24
		Desire for Business **(W23)**	0.15
		Quantity Discount **(W24)**	0.14
		Warranty & aftersales services **(W25)**	0.18
Communication & Responsiveness **(W3)**	0.12	Ability to Fill Emergency Orders **(W31)**	0.29
		Response to Change **(W32)**	0.22
		Process Flexibility **(W33)**	0.24
		Customer Service **(W34)**	0.25
Quality Management **(W4)**	0.18	Quality System **(W41)**	0.21
		Quality of Support Service **(W42)**	0.23
		Meeting Regulatory Requirements **(W43)**	0.19
		Production Facilities and Capabilities **(W44)**	0.13
		Reliability **(W45)**	0.15
		Organisational Leadership **(W46)**	0.09
Process Performance **(W5)**	0.09	Bidding Procedure **(W51)**	0.17
		Technological system and technical support **(W52)**	0.24
		Future Manufacturing Capability **(W53)**	0.19
		Process Capability **(W54)**	0.24
		Design/process improvement **(W55)**	0.16

Supplier Cultural Factors **(W6)**	0.08	Patriotism to same Cultural and Beliefs **(W61)**	0.40
		Location, Local or Foreign **(W62)**	0.33
		Admire History and Heritage **(W63)**	0.28
Supplier Green Practices **(W7)**	0.10	Waste Disposal Schemes **(W71)**	0.27
		Green Procurement **(W72)**	0.30
		Green Technology/ operations **(W73)**	0.23
		Green Certifications **(W74)**	0.20
CSR **(W8)**	0.09	Ethical behaviour **(W81)**	0.22
		Philanthropic responsibility **(W82)**	0.17
		Social Sustainability **(W83)**	0.19
		Environmental Sustainability **(W84)**	0.21
		Economic Sustainability **(W85)**	0.21
Supplier Logistics Performance **(W9)**	0.09	Location **(W91)**	0.21
		Geographical distance **(W92)**	0.19
		Packaging **(W93)**	0.15
		Post-production configuration / ease of assembly **(W94)**	0.22
		Hazardous goods management **(W95)**	0.24

3.6 Numerical Example and Validation of the Current Research Mathematical Model

A numerical example is presented to show how the weights of priorities for the criteria and sub-criteria are computed and to validate the mathematical model used in the current research. According to Saaty (1980), there are two different methods for calculating the overall priorities or the weights of the criteria and sub-criteria: the exact method and the approximate method. Simply put, the exact method starts with raising the comparison matrix to powers, for example, raising the comparison matrix to the power of two and raising the resulting matrix to the

power of two again, and repeating this until all the columns in the matrix become the same.

This procedure creates a matrix called the limit matrix. In this matrix, any columns created reflect the required set of priorities. To solve this matrix, a spreadsheet or AHP-based software packages can be used. The other method is the approximate method, which will be used in the current numerical example. There are three main steps for the approximate method to provide a suitable approximation of the synthesised priorities:

1. Find the summation of the values in each column of the pairwise comparison matrix.
2. Create the normalised pairwise comparison matrix, which is the resulting matrix found by dividing each element in the pairwise matrix by its column total.
3. In the normalised matrix, calculate the average of the elements in each row. This calculation provides an approximation of the relative priorities of the elements.

Table 3.6 The pairwise comparison matrix

Priority	Performance History & Delivery	Reputation	Innovation & Creativity	Amount of Past Business	Marketing Position	Supplier Expertise
Performance History & Delivery	1.00	2.00	0.17	1.00	0.20	0.40
Reputation	0.50	1.00	0.50	2.00	0.25	0.17
Innovation & Creativity	6.00	2.00	1.00	4.00	0.17	1.00
Amount of Past Business	1.00	0.50	0.25	1.00	0.10	0.14
Marketing Position	5.00	4.00	6.00	10.00	1.00	2.00
Supplier Expertise	2.50	6.00	1.00	7.00	0.50	1.00

As an illustrative numerical example, one main criterion was selected from the UK results – *supplier experience* – for the application of the approximation method as per the following tables:

Step 1: Find the summation of the values in each column of the pairwise comparison matrix. The pairwise comparison matrix is shown in Table 3.6 and the summation is shown in Table 3.7.

Table 3.7 Column Sum

	Performance History & Delivery	Reputation	Innovation & Creativity	Amount of Past Business	Marketing Position	Supplier Expertise
Sum	16.00	15.50	8.92	25.00	2.22	4.71

Step 2: Find the normalised matrix by dividing each cell by the total of the column (Table 3.8).

Table 3.8 Normalised Matrix

Normalised	Performance History & Delivery	Reputation	Innovation & Creativity	Amount of Past Business	Marketing Position	Supplier Expertise
Performance History & Delivery	0.06	0.13	0.02	0.04	0.09	0.08
Reputation	0.03	0.06	0.06	0.08	0.11	0.04
Innovation & Creativity	0.38	0.13	0.11	0.16	0.08	0.21
Amount of Past Business	0.06	0.03	0.03	0.04	0.05	0.03
Marketing Position	0.31	0.26	0.67	0.40	0.45	0.42
Supplier Expertise	0.16	0.39	0.11	0.28	0.23	0.21

Step 3: Find the average of the rows in Table 3.8, to provide an approximation of the relative priorities of the elements (Table 3.9).

Table 3.9 Priority Vector

Performance History & Delivery	0.07
Reputation	0.06
Innovation & Creativity	0.18
Amount of Past Business	0.04

Marketing Position	0.42
Supplier Expertise	0.23
Sum	1.00

3.7 Consistency Check

The consistency check is a significant consideration related to the quality of the final decision in terms of the consistency of judgements made by the decision maker during the set of pairwise comparisons. As discussed earlier in this chapter, five steps are followed to check the consistency of the final results:

Step 1: In the pairwise comparison matrix, multiply each value in the first column in Table 3.10 by the relative priority of the first item in Table 3.9 and repeat the same for all other items. To find the vector of the values, calculate the summation of all values within the rows. This vector is called 'the weighted sum' (Table 3.11).

Table 3.10 The weighted sum for the selected item

Performance History & Delivery	0.44
Reputation	0.41
Innovation & Creativity	1.19
Amount of Past Business	0.26
Marketing Position	2.95
Supplier Expertise	1.45

Table 3.11 Weighted Sum/Priority Values

Performance History & Delivery	6.24
Reputation	6.47
Innovation & Creativity	6.70
Amount of Past Business	6.58
Marketing Position	7.02
Supplier Expertise	6.34

Step 3: Calculate the average of the division of the weighted sum and the priority values found in the previous step. The calculated average is expressed as $\lambda_{max,}$ as shown below:

$$\lambda\max = \frac{6.24 + 6.47 + 6.70 + 6.58 + 7.02 + 6.34}{6} = 6.55$$

Step 4: Calculate the CI using Equation 3.1:

$$\mathrm{CI} = \frac{\lambda_{\max} - \mathrm{n}}{\mathrm{n} - 1}$$

Where n is the number of criteria, which = 6.

$$CI = \frac{6.55 - 6}{6 - 1} = 0.11$$

Step 5: Calculate the CR using Equation 3.2:

$$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}}$$

As n = 6, the value of RI = 1.24 (Table 3.3):

$$CR = \frac{0.11}{1.24} = 0.09$$

CR = 0.09, which is less than 10%, meaning that the consistency of the data result is accepted, and the judgement matrix is considered to be consistent.

The final step to finding the overall supplier score for the supplier experience criteria uses the current mathematical formulation (Equation 3.6) and the evaluation of a selected quality manager in a UK construction company. W_{11} to W_{16} are the weights related to the sub-criteria of the supplier experience (W_1), and S_{11} to S_{16} are the scores given by the decision maker (in this example a UK quality manager).

For this example, the score (S_{11} to S_{16}) is a number from 1 to 10 where 1 is the least important and 10 is the most important.

From the results calculated for this study, shown in Table 3.4, $W_1 = 0.04$ and W_{11} to W_{16} are as follows:

$$\mathbf{W_1} \times [(\mathbf{W_{11}} \times \mathbf{S_{11}}) + (\mathbf{W_{12}} \times \mathbf{S_{12}}) + (\mathbf{W_{13}} \times \mathbf{S_{13}}) + (\mathbf{W_{14}} \times \mathbf{S_{14}}) + (\mathbf{W_{15}} \times \mathbf{S_{15}}) + (W_{16} \times S_{16})]$$

$$\mathbf{0.04} \times [(\mathbf{0.07} \times \mathbf{4}) + (\mathbf{0.06} \times \mathbf{3}) + (\mathbf{0.18} \times \mathbf{5}) + (\mathbf{0.04} \times \mathbf{4}) + (\mathbf{0.42} \times \mathbf{6}) + (\mathbf{0.23} \times \mathbf{7})] = \mathbf{0.235}$$

The percentage of the overall score for supplier experience according to the decision of a UK quality manager = **23.5**

CHAPTER 4: RESULTS AND DISCUSSION

This chapter presents the results of the current research. The results are presented according to the research method applied. The chapter also delineates the relationship between the results and previous works. The chapter ends with a discussion where research questions are answered with current findings.

4.1 Qualitative Results

The first finding of the interviews is that the research participants used a set of criteria in assessing and selecting their suppliers. It was found during the interview analysis that the study participants used more than 20 criteria to evaluate and select their suppliers. This finding is in line with the arguments of some scholars, such as Chai and Ngai (2020), Azadfallah (2017) and Özfirat et al. (2014), that MCDM is commonly employed by many companies. According to the research participants, they used different criteria at different times for different suppliers. Thus, the type of products or services needed by the buying company determines the criteria to be used. This finding is common to all participating companies in the current research regardless of their country. The finding validates the work of Dickson (1966), who historically pinpointed that several criteria were often used by companies to select their suppliers. Similarly, this result complements the work of Carter (2005). This result also supports the claims of Monczka et al. (2011) who stated that the selection criteria depended on the type of materials, products or services needed.

The second finding is that the selection criteria outlined in the current research were very important. The research participants expressed that they selected their suppliers according to financial capability, experience, quality, and price or cost, as argued by previous scholars, such as Cengiz et al. (2017), Zimmer et al. (2016), Ulutas et al. (2016), Pal et al. (2013) and Mwikali & Kavale (2012). Meanwhile, it was learned from their explanations during the interviews that the key selection criteria consist of supplier experience, financial position, communication and responsiveness, quality management, process performance, cultural factors, green practices, CSR, and logistic performance. Similarly, it was learned that the study

participants had a list of sub-criteria. For example, when a participant mentioned ‘price’, they explained sub-criteria such as quantity discount, warranty, quality, delivery time, and aftersales services. This finding collaborates the claims of Thakur and Anbanandam (2015), Yildiz and Yayla (2015), Lysons and Farrington (2012) and Beil (2009), who stated that there are several criteria and each criterion might have some sub-criteria. These scholars also noted that the criteria might not always be defined expressly. The implied sub-criteria were also noted during the qualitative analysis.

The third finding is that there is a cultural influence in supplier selection decision-making. The participants tried to avoid the issue of culture at the beginning of the interview. Meanwhile, when they were explaining some criteria, such as financial position, quality, and delivery, the cultural factors, specifically patriotism, the origin of the supplier and their products, and heritage criteria came out. The participants did not focus on religious factors but, instead, they focused on locally made products with traditional values. The participants, despite being highly educated and globally exposed, showed much love for their own-country materials. This finding is complemented by the claims of Rose (2001) and Livanis et al. (2016) who stated that there is always cultural influence on supplier selection. These scholars noted that cultural factors are often silent or hidden within the supplier decision makers. Similarly, this finding confirmed the work of Becker and El-Said (2013). It also confirmed the explanation of Hofstede et al. (1990) who expatiated that national culture has an impact on organisational culture as well as individual decision makers. Similarly, this result proves that organisational culture has an impact on supplier selection, as claimed by Belassi et al. (2017), Cadden et al. (2013), Liu et al. (2010) and Petersen et al. (2005).

Outside of cultural factors, it was found that there are many women in managerial positions in the UK – more than in the UAE. This shows that there is an almost equal employment gender balance in the UK, unlike the UAE. Again, the result reveals the cultural dimensions noted by Hofstede et al. (1990), who stated the UK and many

European countries are not masculine-biased, while Middle Eastern countries are masculine-biased.

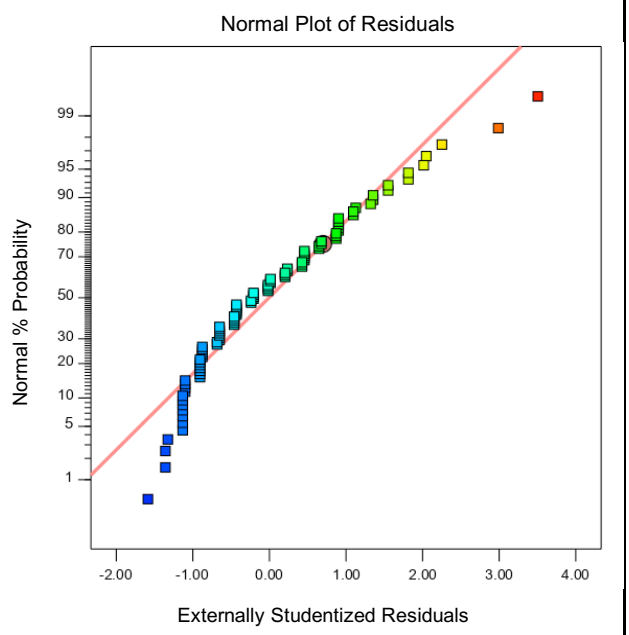
4.2 Quantitative Results

Based on the quantitative analyses, it was noted that there are differences and similarities between the UK and UAE in the supplier selection decision. The first finding is that some criteria are evaluated in the same way in both countries. Specifically, the supplier experience, supplier cultural factors, and logistic performance are ranked the same way according to the ANOVA test results. This means that these criteria have almost the same value in both countries. Meanwhile, it is noted that the sub-criteria of these criteria are different. For instance, for supplier experience, the UK decision makers considered supplier expertise as their main sub-criterion, while the UAE decision makers preferred suppliers' performance history and delivery to any other sub-criteria. The following tables and figures show the details. This section presents the UK and UAE comparison results; however, the UK results were also analysed separately and the same was done for the UAE results, as shown in Appendix C.

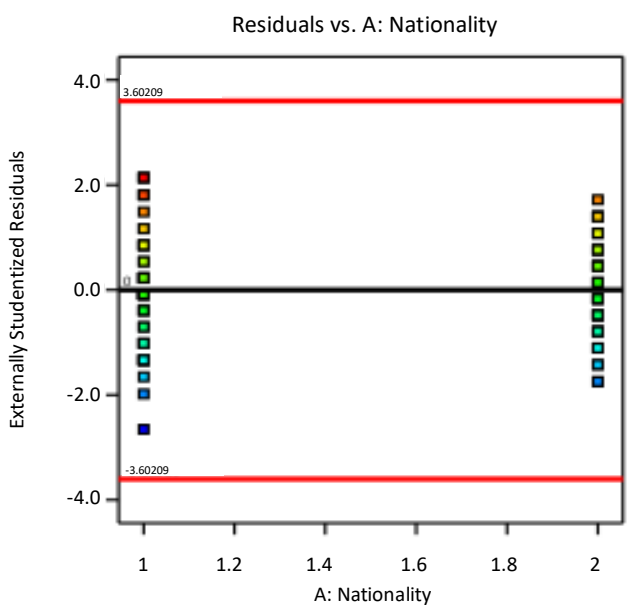
Table 4.1 ANOVA Table for Supplier Experience

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0013	1	0.0013	1.24	0.2691	not significant
A-Nationality	0.0013	1	0.0013	1.24	0.2691	
Pure Error	0.1028	98	0.0010			
Cor Total	0.1041	99				

The above table shows that the model's p-value is 0.2691, which is greater than 0.05. This indicates that the supplier experience criterion does not differ between the UK and UAE in the decision of the choice of suppliers. To validate the above table, the ANOVA result needs to be cross-examined by model graphics.



Normal Probability Plot



Residual vs. Evaluating Criteria

Figure 4.1 Model Adequacy Check for ANOVA of Supplier Experience

The model graphic shows that normal probability plots are plotted points and these plotted points can be represented by a straight line. This means that the residuals follow the approximately normal distribution. The plot of the residual versus its evaluating criteria shows that the errors have approximately constant variance and the data contained no outliers. Thus, the diagnostic examination of the residual revealed that there are no violations of any ANOVA underlying assumptions. This implies that the ANOVA results can be trusted. To ensure credibility with this result, the least significant difference model (LSD) graph was also used. It is shown in the following figure.

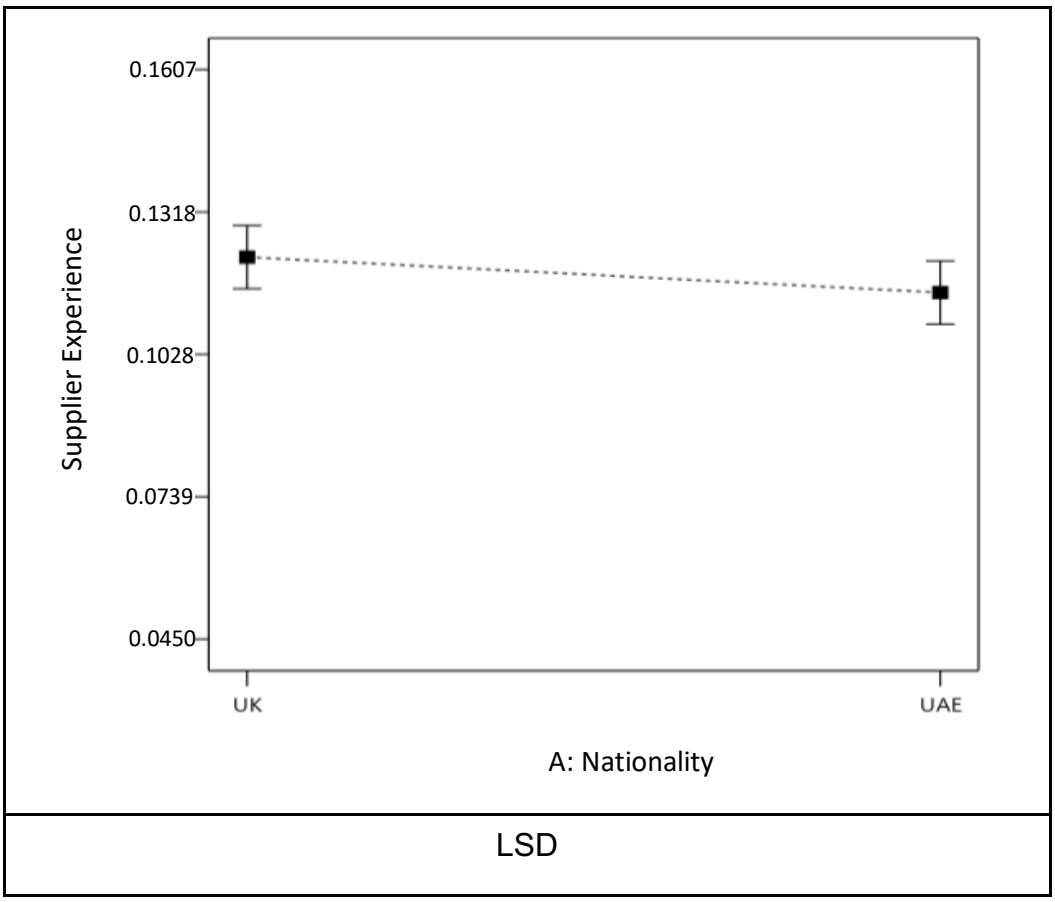


Figure 4.2 The Least Significant Difference Plot for Supplier Experience

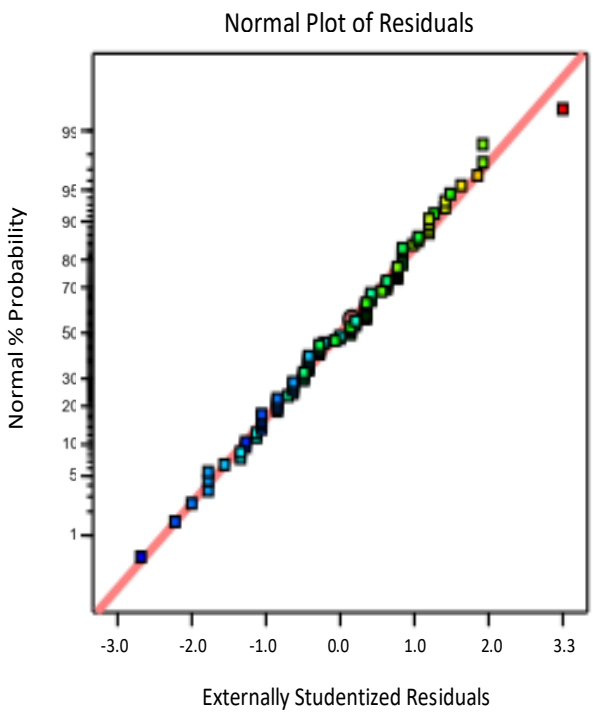
The LSD plot shows that there is an overlap between the two countries' evaluation results. It affirms that there is no difference in the importance of these criteria in the supplier selection decision. This result validates the first finding of the qualitative results. It shows that the supplier decision makers employed some criteria regardless of their country of operation. This result affirms the proposition of Monczka et al. (2011), Carter (2005) and Dickson (1966). Similarly, this result affirms Watt et al. (2010) and Kilincci and Aslı Onal (2011), who proposed this criterion and its sub-criteria. This result also supports the claims of Van de Rijt et al. (2010), Albano et al. (2006) and Wong et al. (2000), who argued that suppliers' experience could enable them to get selected in the private sector as well as in the public sector, as claimed by Spagnolo (2012), Snider and Walkner (2009), Mills (2005) and Shugart (2005).

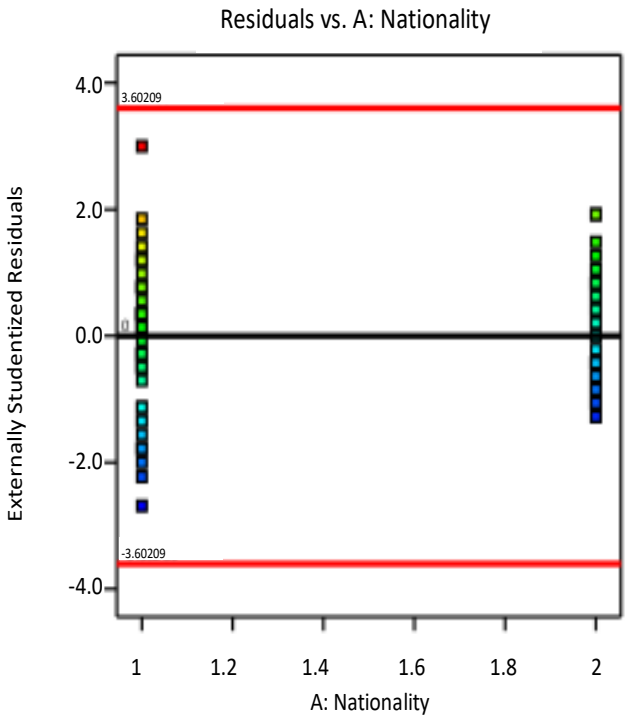
The second finding is that the remaining six main criteria in the current research framework are evaluated differently by UK and UAE decision makers; these include the financial position, communication and responsiveness, quality management, process performance, CSR, and green practices. In the supplier financial position criterion, both UK and UAE decision makers valued financial stability as the most important sub-criterion. Furthermore, those in both the UK and UAE agreed that the desire for business and quantity discount are not that important when choosing their suppliers. Although the warranty and aftersales service are very important to the UK decision makers, the UAE decision makers do not appreciate them as much. Moreover, the cost and price criterion is the second most important after financial stability for both countries. The following tables and figures show the details.

Table 4.2 ANOVA Table for Supplier Financial Position

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0708	1	0.0708	30.90	< 0.0001	significant
A-Nationality	0.0708	1	0.0708	30.90	< 0.0001	
Pure Error	0.2244	98	0.0023			
Cor Total	0.2952	99				

As shown in the ANOVA (Table 4.2), the model's p-value is small (< 0.0001). Thus, it can be assumed that there is a significant difference between the UK and UAE decision makers over the choice of suppliers. The ANOVA was checked by the model graphics and LSD. Their outcomes are shown below:





Normal Probability Plot	Residual vs. Evaluating Criteria

Figure 4.3 Model Adequacy Check for Supplier Financial Position

The normal probability plots can be represented by a straight line. This means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria shows that the errors have approximately constant variance and the data contained no outliers. Therefore, the diagnostic examination of the residual revealed that there were no violations of the ANOVA underlying assumptions. ANOVA results can be trusted as was proved in the following figure.

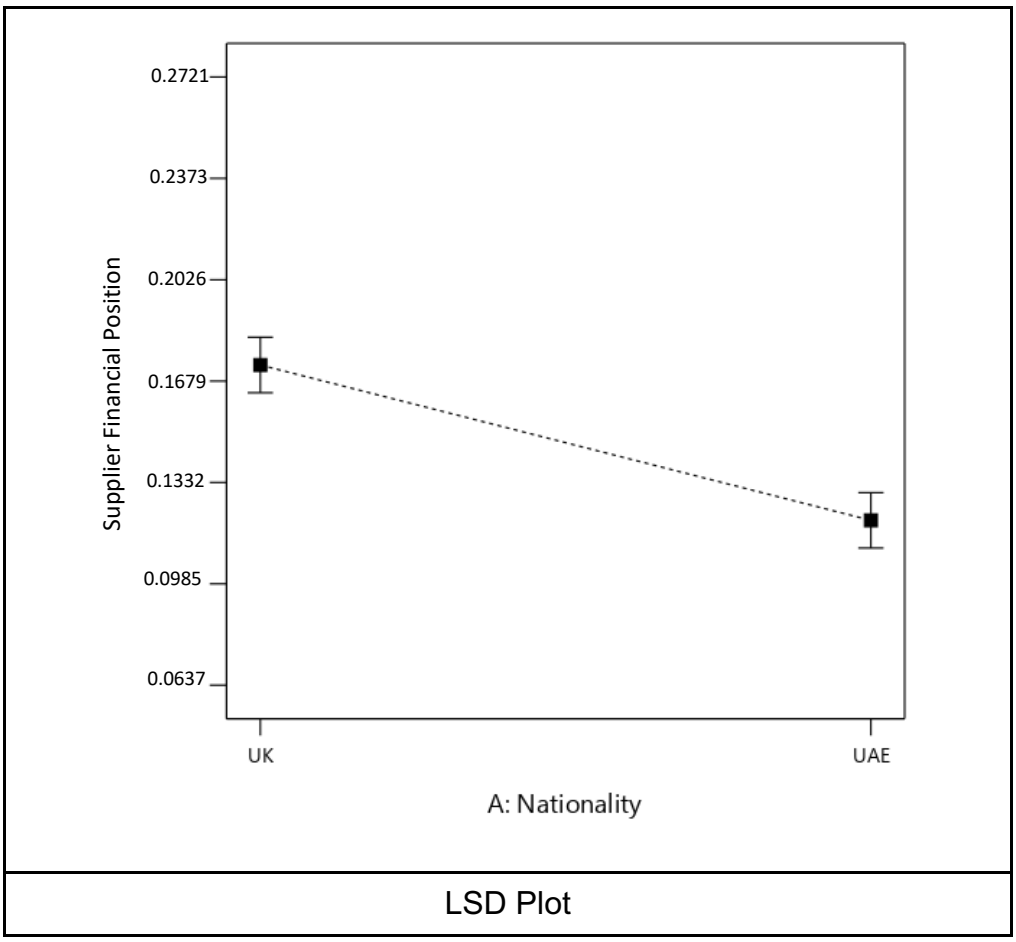


Figure 4.4 The Least Significant Difference Plot for Supplier Financial Position

The LSD plot shows that the supplier financial position criterion is more important for the UK than for UAE buyers when making decisions regarding supplier selection. Therefore, ANOVA can be accepted. This indicates the model is significant at a significance level of less than 0.0001. The financial position criterion was said to be a key criterion for supplier selection according to Hamdan and Cheaitou (2017a), Kilincci and Aslı Onal (2011) and Cousins et al. (2006). This finding also affirms the claims of these previous scholars: Danese (2013), Carter et al. (2010), and Ghodsypour and O'Brien (1998). Meanwhile, the current finding pinpoints that the sub-criteria of financial position differed from one country to another, especially in the construction industry.

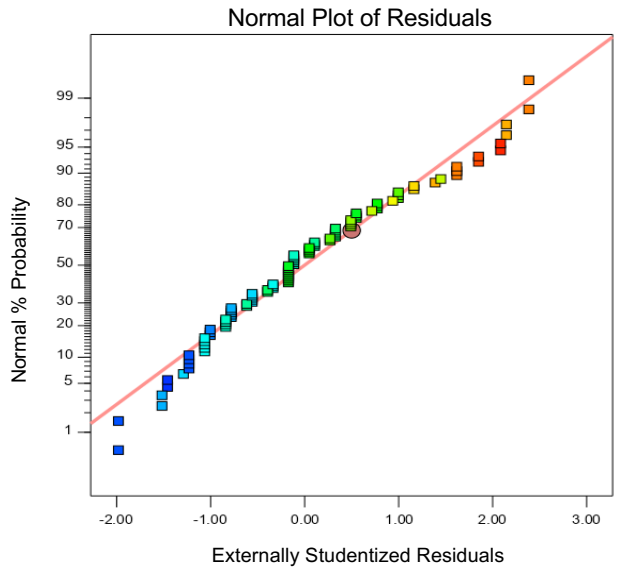
Moving forward to the communication and responsiveness criterion, both UK and UAE decision makers valued the ability to fill emergency orders as the most

important sub-criterion. But, for the UK managers, customer services comes in at the second most important position, while it was the least important sub-criterion for the UAE managers.

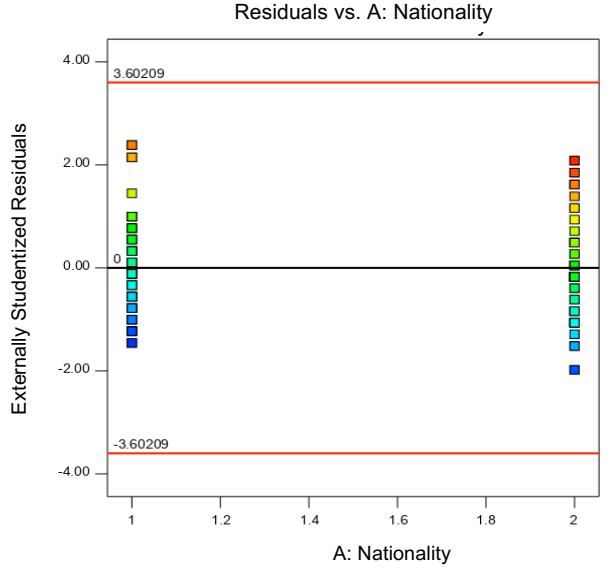
Table 4.3 ANOVA Table for Communication and Responsiveness

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0250	1	0.0250	15.48	0.0002	significant
A-Nationality	0.0250	1	0.0250	15.48	0.0002	
Pure Error	0.1580	98	0.0016			
Cor Total	0.1830	99				

The ANOVA model's p-value is extremely small (0.0002) and, thus, it can be assumed to be significant. This indicates that the communication and responsiveness criterion has a significantly different importance for the UAE and UK buyers in the decision over the choice of suppliers.



Normal Probability Plot



Residual vs. Evaluating Criteria

Figure 4.5 Model Adequacy Check for Communication and Responsiveness

The above normal probability plots can be represented by a straight line. Similarly, the plot of the residual versus its evaluating criteria is straight. These plots show that the errors have approximately constant variance and the data contain no outliers. Thus, there are no violations of the ANOVA assumptions and the data can be trusted.

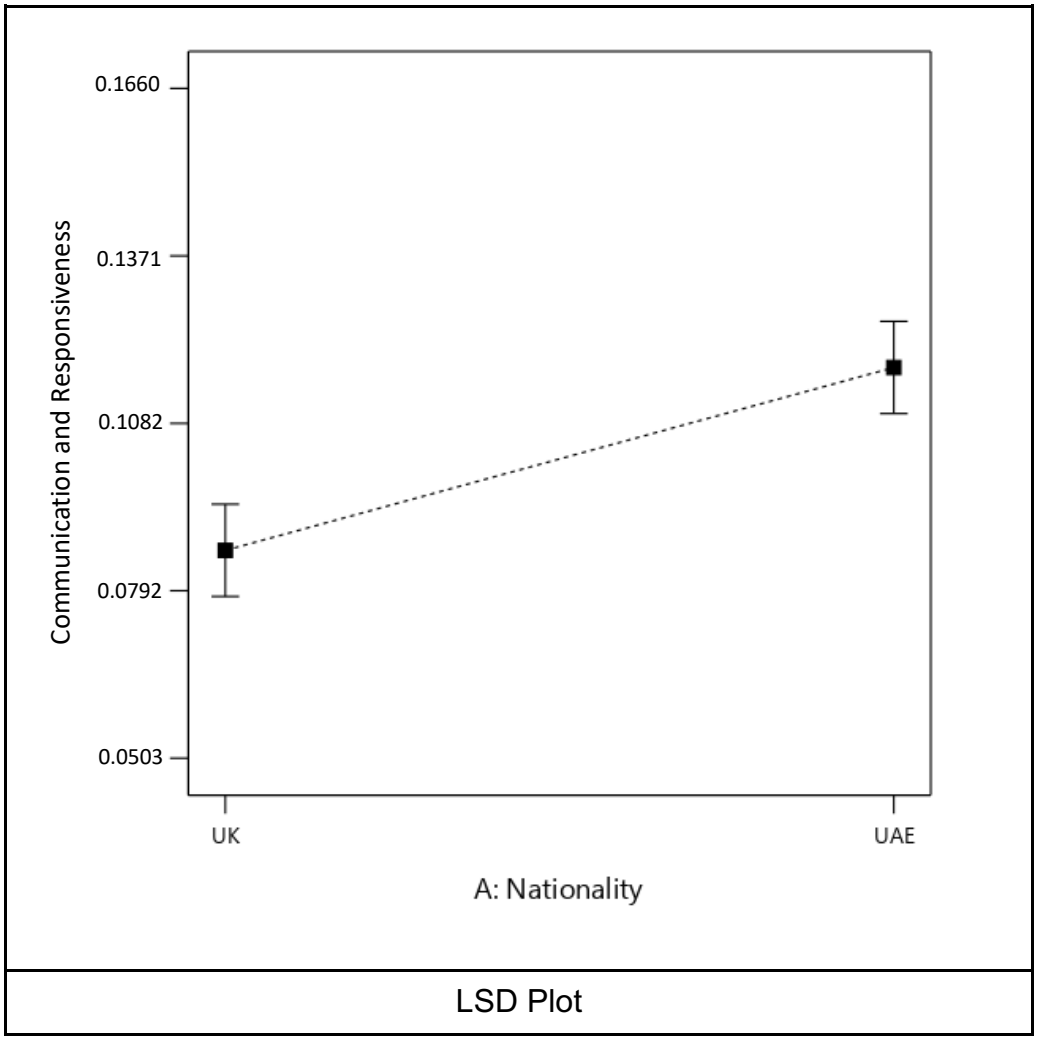


Figure 4.6 The Least Significant Difference Plot for Communication and Responsiveness

The above LSD plot shows that the supplier communication and responsiveness criterion is more important for UAE buyers than those from the UK in the supplier selection decision. This result reveals that the arguments of Lima-Junior and Carpinetti (2016), Shahanaghi and Yazdian (2009), and Christopher and Juttner

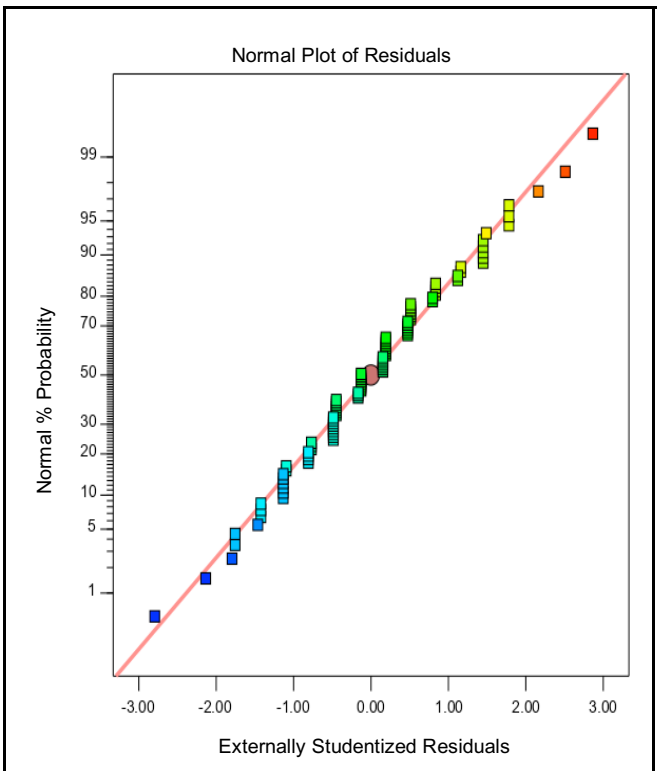
(2000) seem to be important in the selection of suppliers. These scholars argued that of a supplier's ability to respond to an unexpected situation plays a significant role in their consideration. Meanwhile, this result reveals that the country of operation determines specific sub-criteria to be used by decision makers for supplier selection, especially in the construction industry.

Furthermore, in the supplier process performance criterion, the UK and UAE decision makers valued process capability as the most important sub-criteria, followed by technological system and technical support. Moreover, the UK and UAE buyers agreed that the bidding procedure is not that important for them when choosing their suppliers compared with the other sub-criteria. The following analyses supported the finding.

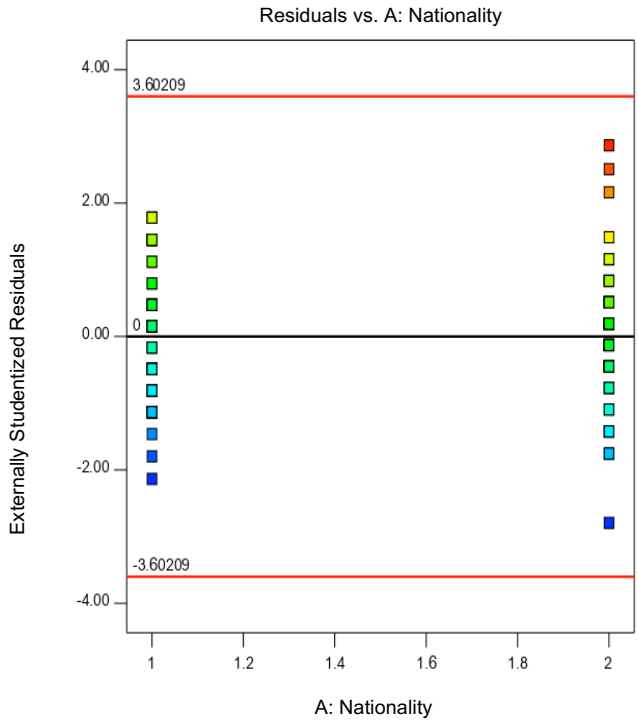
Table 4.4 ANOVA Table for Process Performance

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0088	1	0.0088	8.96	< 0.0001	significant
A-Nationality	0.0088	1	0.0088	8.96	< 0.0001	
Pure Error	0.0966	98	0.0010			
Cor Total	0.1055	99				

The above ANOVA table shows that the p-value is small (< 0.0001). Thus, it can be assumed that the difference between the UK and UAE decision makers on process performance is significant. Likewise, the model graphics were tested and showed that there was no violation of the ANOVA assumptions, as shown in the following figures.



Normal Probability Plot



Residual vs. Evaluating Criteria

Figure 4.7 Model Adequacy Check for Process Performance

The above normal probability plot can be represented by a straight line and it means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria shows that the errors have approximately constant variance and the data contain no outliers. Thus, the indication is that the model is significant at a significance level equal to 0.0001. This is also supported by the following LSD plot.

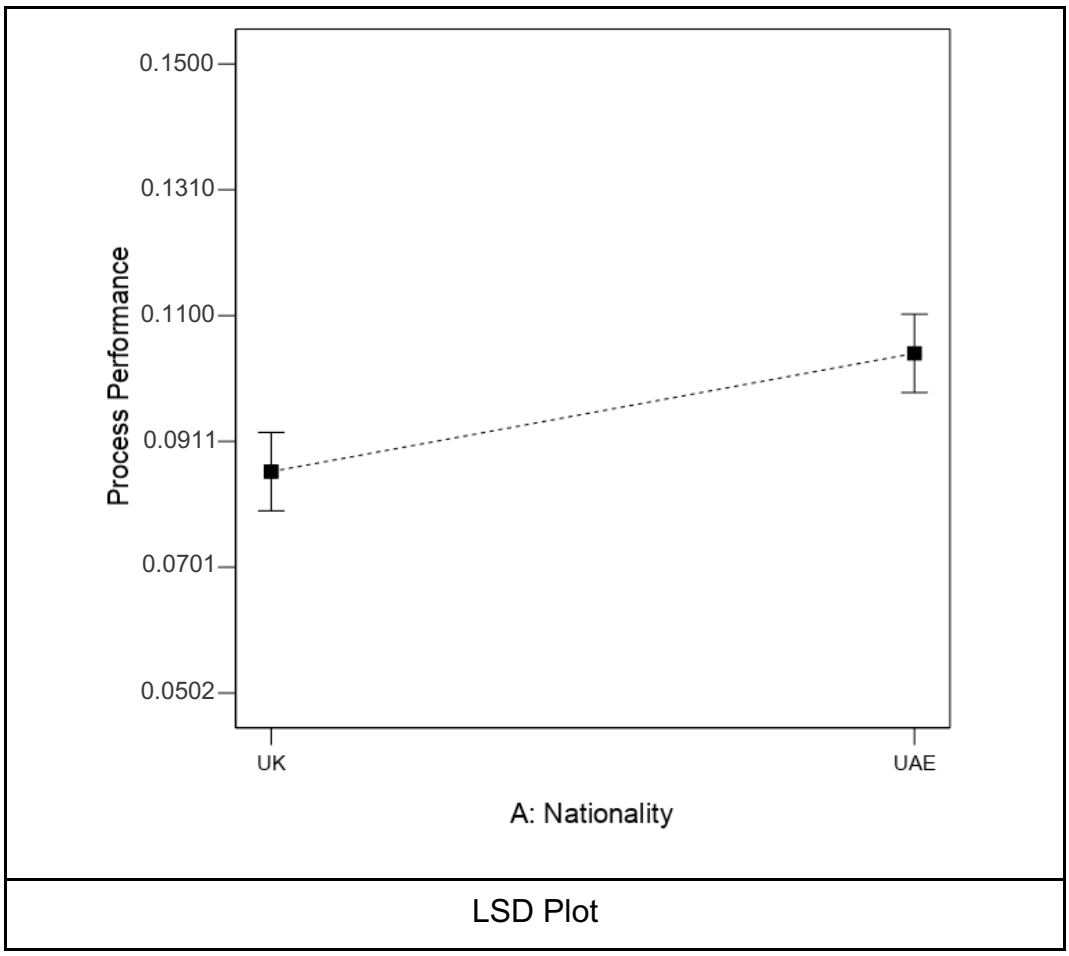


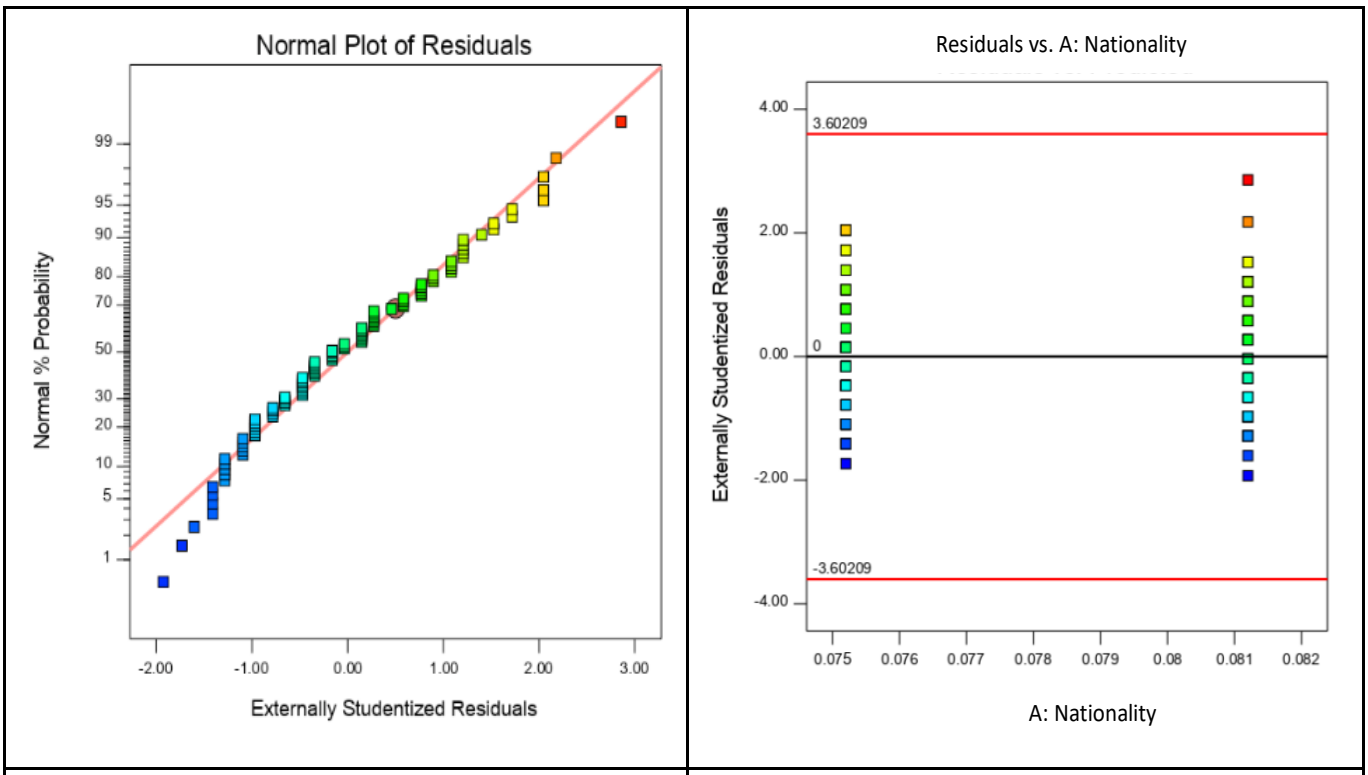
Figure 4.8 The Least Significant Difference Plot for Performance Process

The LSD plot shows that the supplier process performance criterion is slightly more important for UAE than UK buyers when selecting suppliers. This finding validates the claims of Chen and Chao (2012), Sodenkamp et al. (2016) and Rao et al. (2017) that the performance of the supplier is an essential criterion in selecting suppliers. Similarly, this finding supports the claims of You et al. (2015), Ayhan and Kilic (2015), Polat and Eray (2015), Waris et al. (2014), Mukherjee (2014), Pal et al. (2013) and Chen and Chao (2012), who claimed that the technological capability and technical support of suppliers are very essential. The finding reveals that the UK and UAE decision makers considered this criterion in the process of supplier selection. Meanwhile, the finding reveals that there is a difference in the sub-criteria, as well as bidding procedure not being necessary for selecting suppliers in the construction industry.

Another finding is that the UAE and UK decision makers evaluated supplier cultural factors as the least important criteria from the nine main criteria. Moving on to the supplier cultural sub-criteria, the UK decision makers agreed that all sub-criteria – patriotism (for the same culture and beliefs), location (local or foreign), and admiring history and heritage – are equally important in the decision over supplier selection. On the other hand, the UAE decision makers agreed that patriotism for the same culture and beliefs is the most important criterion, followed by location, and the least important criterion is admiring history and heritage. This result indicates that the decision makers are hiding cultural factors, as they showed in their interviews. Nonetheless, the following ANOVA Table 4.5 shows that the p-value is 0.2549, which is greater than 0.05. This indicates that the model terms are not significant, which means that the cultural criterion does not have any significant difference in importance between UAE and UK buyers in the decision over the choice of suppliers. Both UK and UAE buyers valued this criterion equally.

Table 4.5 ANOVA Table for Cultural Factors

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0005	1	0.0005	1.31	0.2549	not significant
A-Nationality	0.0005	1	0.0005	1.31	0.2549	
Pure Error	0.0354	98	0.0004			
Cor Total	0.0358	99				



Normal Probability Plot	Residual vs. Evaluating Criteria

Figure 4.9 Model Adequacy Check for Cultural Factors

The model graphics show the underlying assumptions of the ANOVA can be upheld. The normal probability plot also shows that the residuals follow an approximately normal distribution. Thus, the ANOVA results can be trusted, and the model is not significant, with a significance level equal to 0.2549. This is confirmed in the following LSD model.

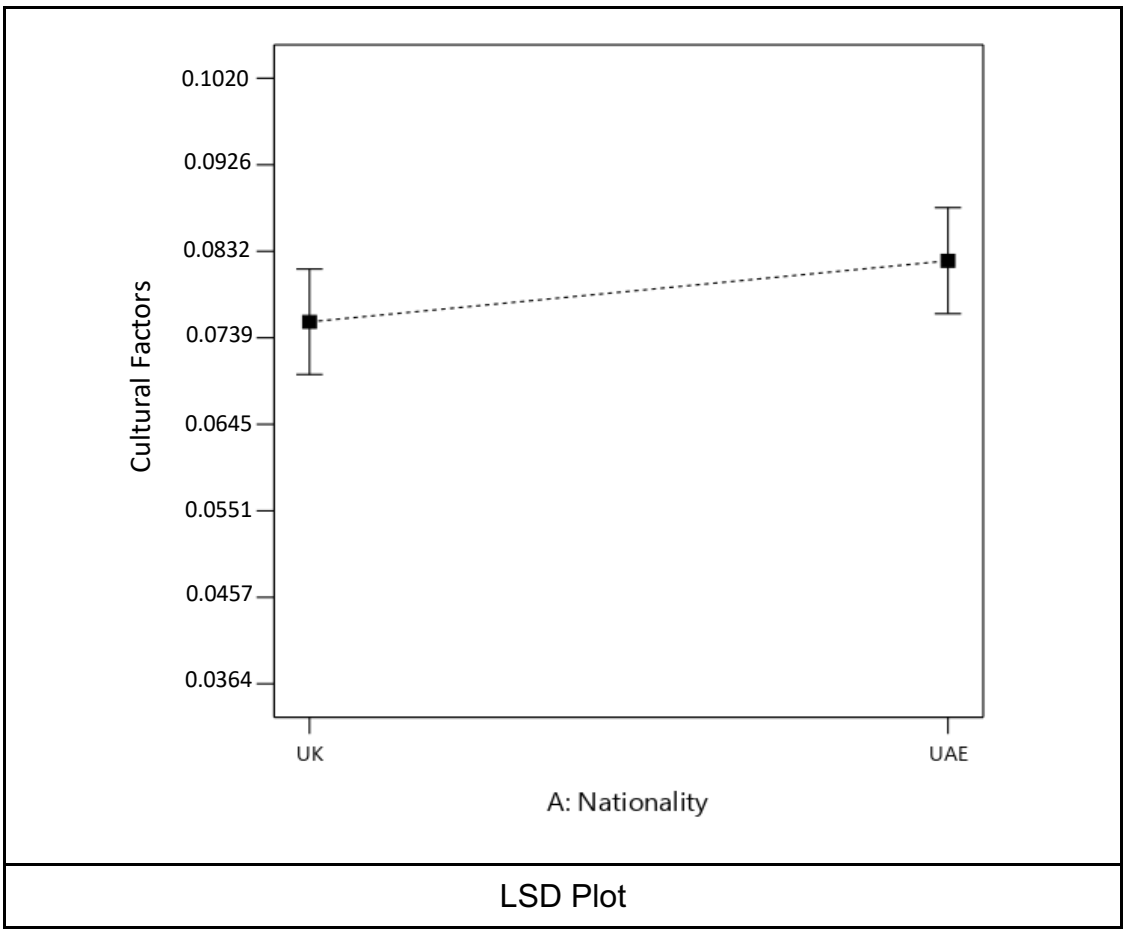


Figure 4.10 The Least Significant Difference Plot for Cultural Factors

The LSD revealed that the cultural factors criterion is evaluated equally by decision makers (buyers) from the UAE and the UK. This implies that the output of the ANOVA is validated. This result validates the qualitative findings of the current research. It shows that there is a limited interest in sharing or discussing publicly the cultural influence in selecting suppliers. These results also reveal that there is implied cultural influence in supplier selection, as shown in the work of Livanis et al. (2016), and Morgan and Hunt (1994).

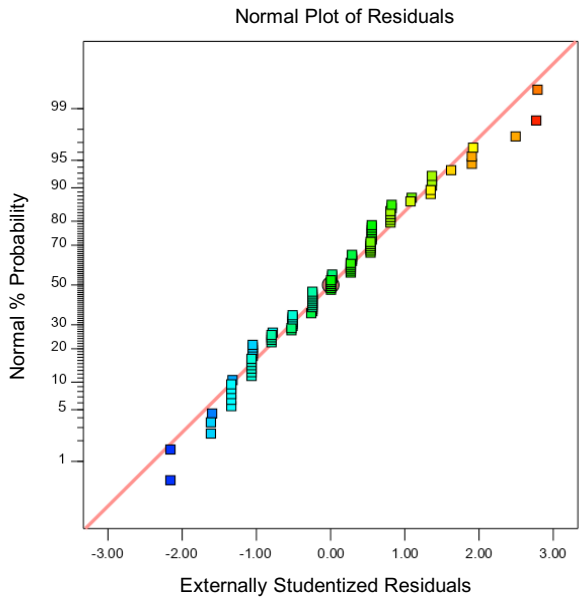
The analysis of green practices criterion showed that the UK decision makers valued green technology/operations as the most important sub-criterion of the green practices, but the UAE decision makers ranked green procurement as the most important sub-criterion. Similarly, the second most important sub-criterion for the UK was green certification and for the UAE it was waste disposal schemes. The least

important sub-criteria for the UK were green procurement and waste disposal schemes, while the UAE decision makers considered green technology/operations and green certifications as the least important sub-criteria in the decision over supplier selection. The following statistical analyses show the details.

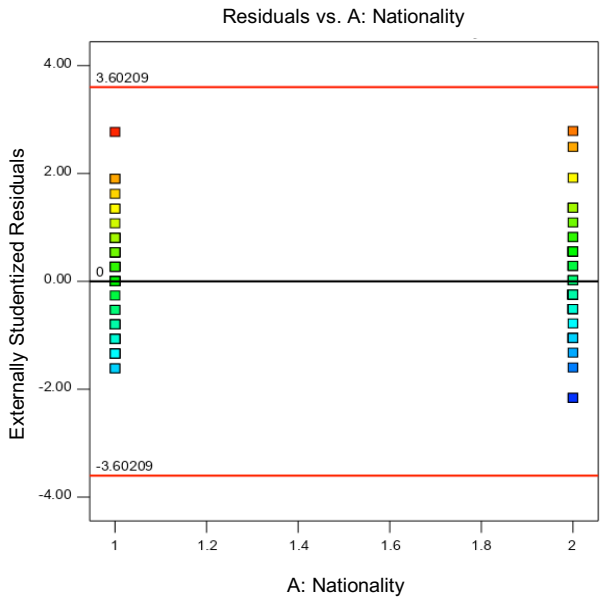
Table 4.6 ANOVA Table for Green Practices

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0106	1	0.0106	7.44	0.0001	significant
A-Nationality	0.0106	1	0.0106	7.44	0.0001	
Pure Error	0.1397	98	0.0014			
Cor Total	0.1503	99				

As shown from the ANOVA, the model's p-value is small (< 0.0001) and thus it can be assumed to be significant, which means that this criterion is significantly different between the UAE and the UK in the decision over the choice of suppliers.



Normal Probability Plot



Residual vs. Evaluating Criteria

Figure 4.11 Model Adequacy Check for Green Practices

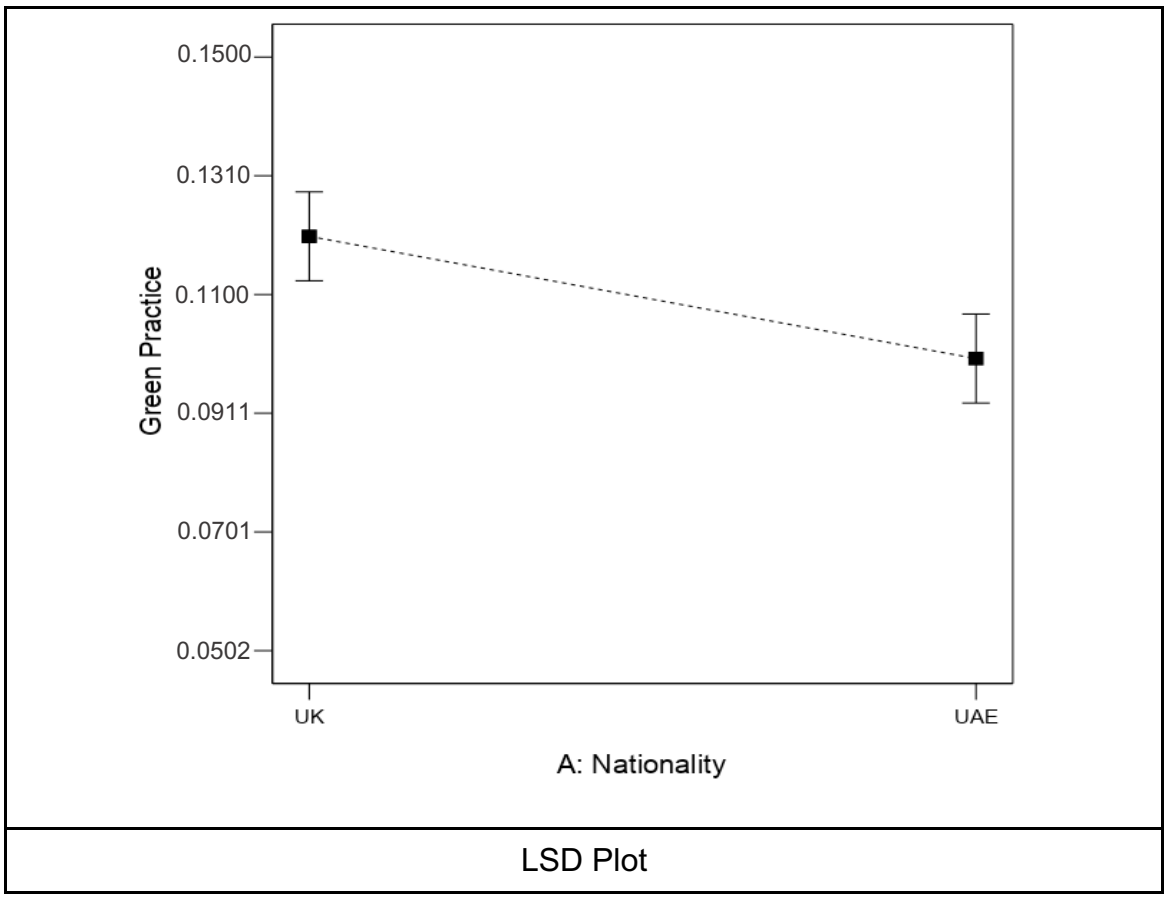


Figure 4.12 The Least Significant Difference Plot for Green Practices

The model graphics show that ANOVA can be trusted. Likewise, the model check and LSD plot show that the green practices criterion is more important for the UK than for UAE buyers when selecting suppliers. This result shows that cultural factors and national policies influence supplier selection decision makers. For instance, there is strict regulation in the UK for certain operations and this made the decision makers in that country prefer green certification. Likewise, there is a strict requirement for waste disposal in the UAE and this made the decision makers take waste disposal seriously, as Kumar et al. (2014) and Shen & Yu (2013) stated. Thus, this finding complements the work of Winter and Lasch (2016), Hashemi et al. (2015), Piercy et al. (1997) and Katsikeas and Leonidou (1996).

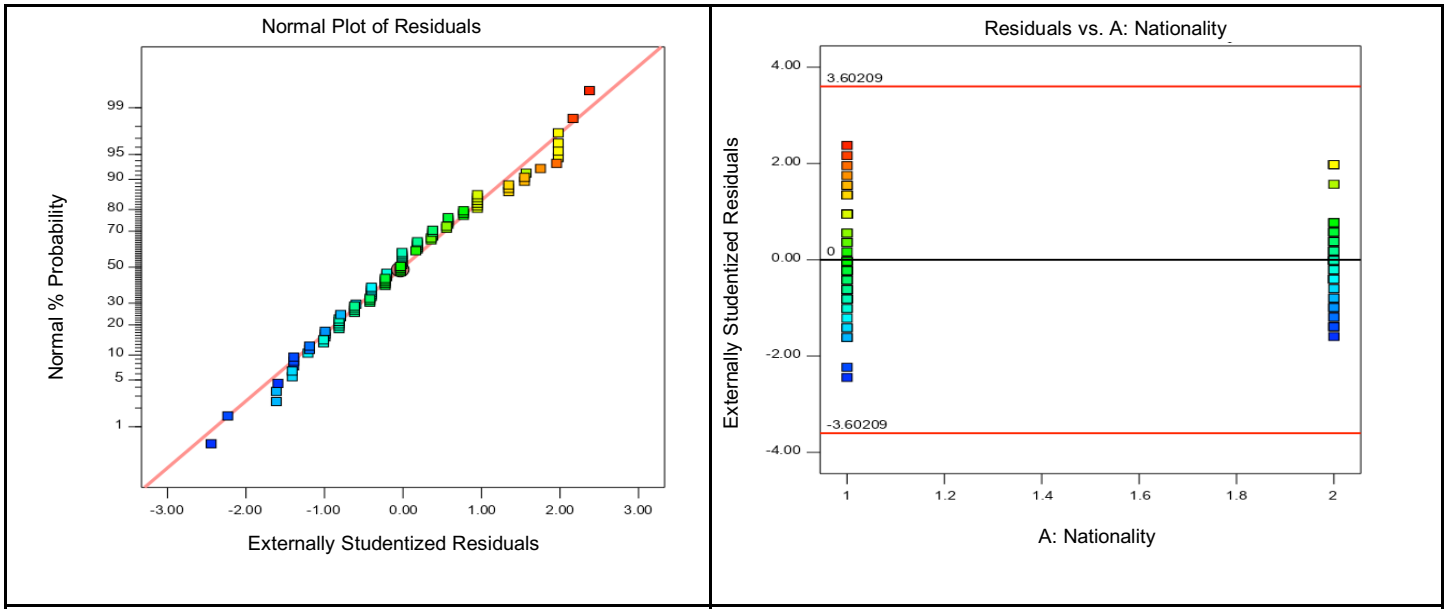
The findings for the corporate social responsibility (CSR) criterion show that both UK and UAE buyers agreed that environmental sustainability was the most important sub-criterion. Meanwhile, the UAE decision makers valued ethical behaviour and

economic sustainability as the most important sub-criteria and the UK decision makers believed that ethical behaviour and economic sustainability came after environmental sustainability as the second and third most important sub-criteria. Moreover, both UK and UAE buyers valued philanthropic responsibility as the least important sub-criterion. The following table and figures show the details.

Table 4.7 ANOVA Table for CSR

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0135	1	0.0135	9.15	0.0032	significant
A-Nationality	0.0135	1	0.0135	9.15	0.0032	
Pure Error	0.1442	98	0.0015			
Cor Total	0.1576	99				

As shown from the ANOVA, the model's p-value is small (0.0032) and thus it can be assumed to be significant, which indicates that this criterion is significantly different between the UAE and the UK in the decision over the choice of suppliers.



Normal Probability Plot	Residual vs. Evaluating Criteria

Figure 4.13 Model Adequacy Check for CSR

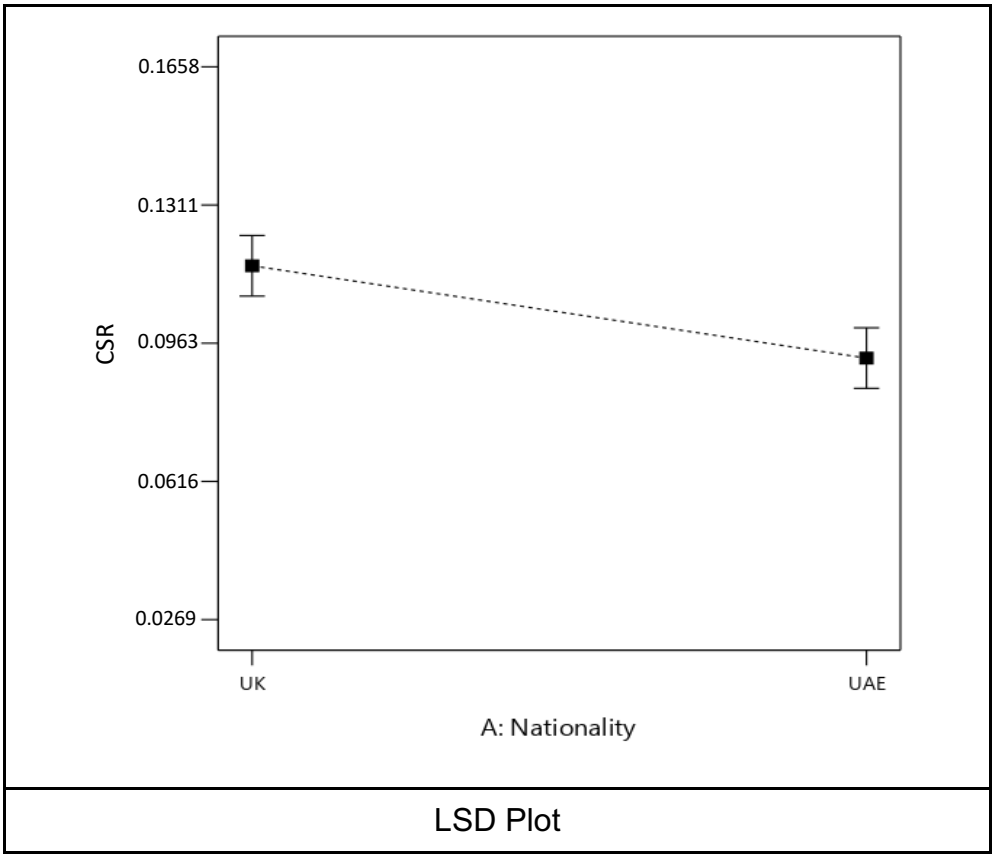


Figure 4.14 The Least Significant Difference Plot for CSR

The above models show that ANOVA is trusted and validated. The models also prove that the CSR criterion is more important for UK decision makers than for UAE decision makers in supplier selection. This result validates the claims of Kumar et al. (2014), Xu et al. (2013) and Carter (2005) that CSR is an important criterion and relates to the cultural factor. The cultural factor is more evident in the UAE in the current research; the same outcome is found for CSR. This implies that there is some relationship between the cultural and CSR factors in supplier selection in the construction industry.

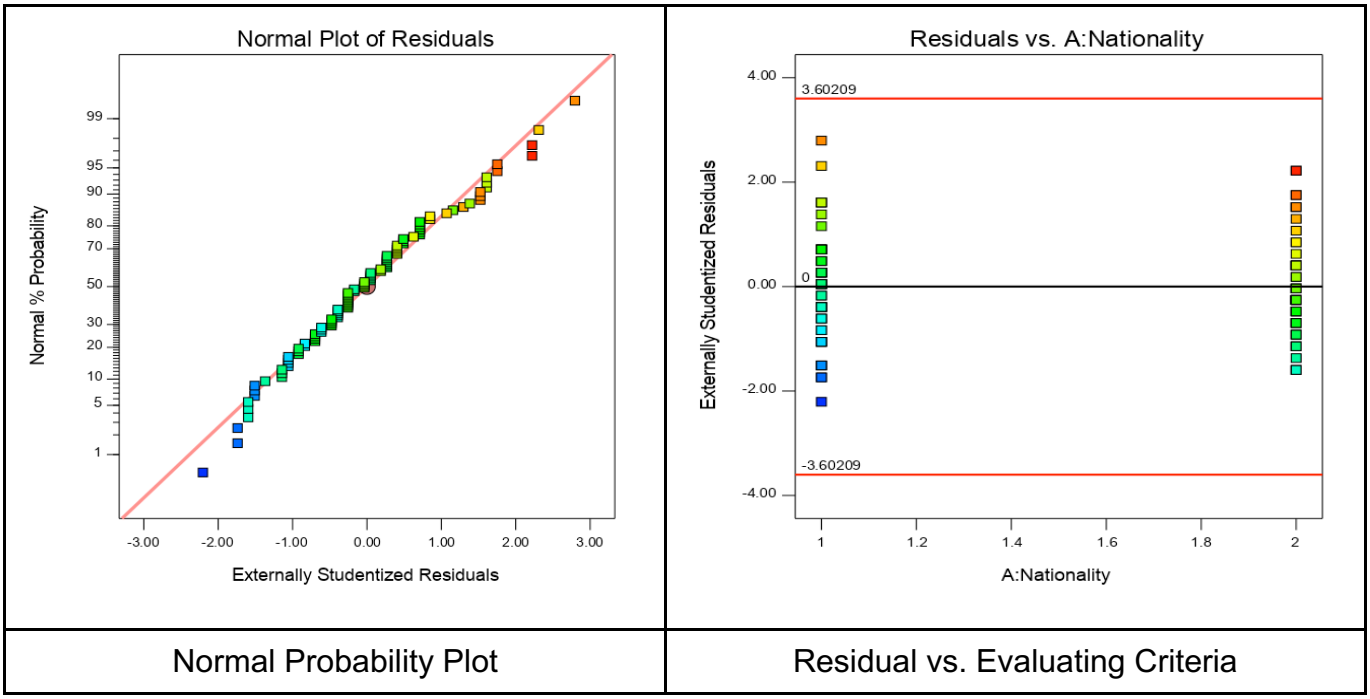
Quality management is also very important to the UK and UAE decision makers. Both groups agreed that quality systems and support services are essential for them in selecting the right supplier. Meanwhile, the UK decision makers regarded meeting regulatory requirements more important than the reliability of the supplier. Conversely, the UAE decision makers considered the reliability of suppliers more

important than meeting the regulatory requirements. Again, this finding reveals the influences of national culture and policies on supplier selection. The following statistical table and figures show the details.

Table 4.8 ANOVA Table for Quality Management

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0720	1	0.0720	34.71	< 0.0001	significant
A-Nationality	0.0720	1	0.0720	34.71	< 0.0001	
Pure Error	0.2000	98	0.0021			
Cor Total	0.2800	99				

The above ANOVA table shows that the model's p-value is small (< 0.0001). It indicates that this criterion is significantly different between the UAE and the UK in the decision over the choice of suppliers.

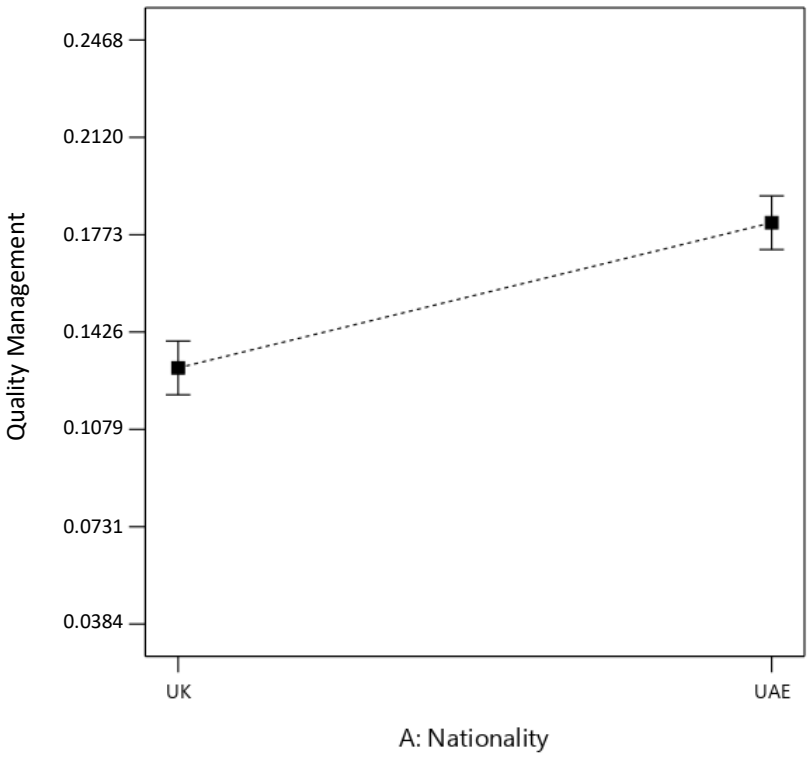


Normal Probability Plot	Residual vs. Evaluating Criteria

Figure 4.15 Model Adequacy Check for Quality Management

The above models show that the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions. It means that the ANOVA results

can be trusted and validated. Therefore, there is a difference between the UK and UAE decision-making with regard to the quality management criterion, as proved in the following LSD plot.



LSD Plot

Figure 4.16 The Least Significant Difference Plot for Quality Management

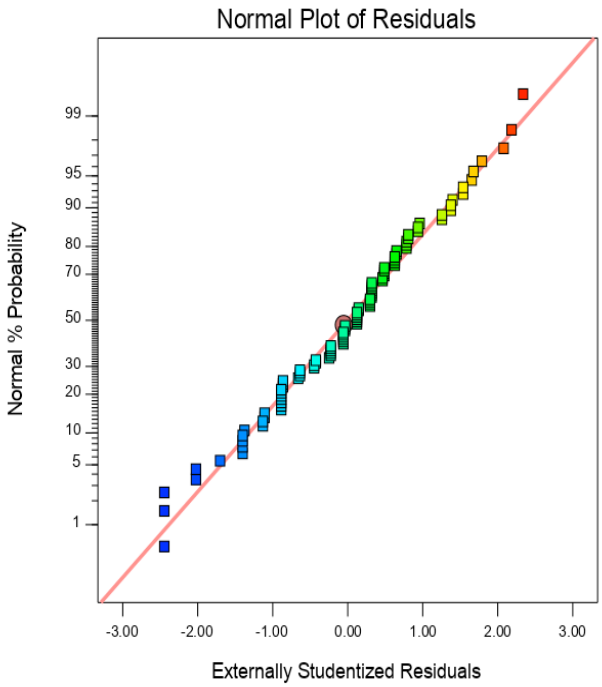
The above finding complements the work of Govindan et al. (2018), Sarkis and Dhavale (2015), Zhang et al. (2006), and Tracey and Chong (2001). Specifically, the finding supports the claims of Kumar et al. (2009) for reliability and Trapp and Sarkis (2016) and Sarkis and Dhavale (2015) for meeting regulatory requirements.

The last finding is about logistics performance. The UK decision makers agreed that hazardous goods management is the most important sub-criterion, while the UAE decision makers agreed that geographical distance is the most important sub-criterion. Both agreed that packaging is the least important sub-criterion. The following table and figures show the details.

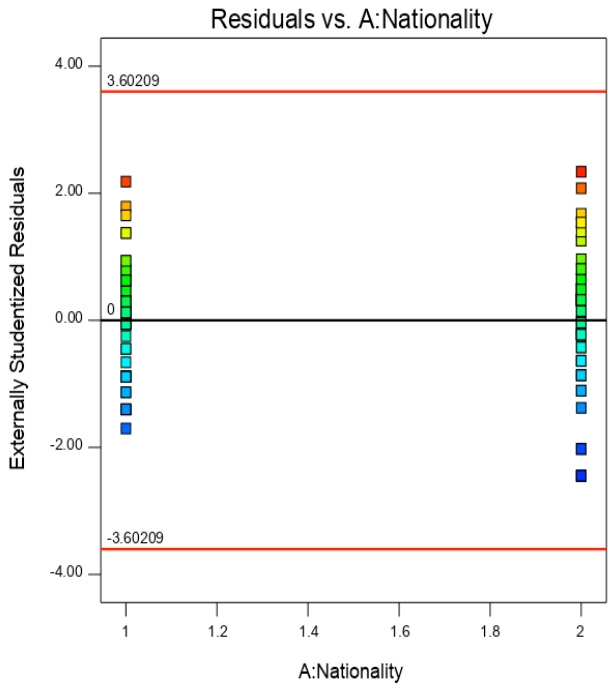
Table 4.9 ANOVA Table for Supplier Logistics Performance

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0001007	1	0.0001007	0.17	0.6822	not significant
A-Nationality	0.0001007	1	0.0001007	0.17	0.6822	
Pure Error	0.0059	98	0.000597			
Cor Total	0.1400	99				

As shown in the ANOVA Table 4.9, the model's p-value is 0.6822, which is greater than 0.05. This indicates the model terms are not significant, which means that this criterion does not differ between the UAE and the UK in the decision over the choice of supplier.



Normal Probability Plot



Residual vs. Evaluating Criteria

Figure 4.17 Model Adequacy Check for Supplier Logistics Performance

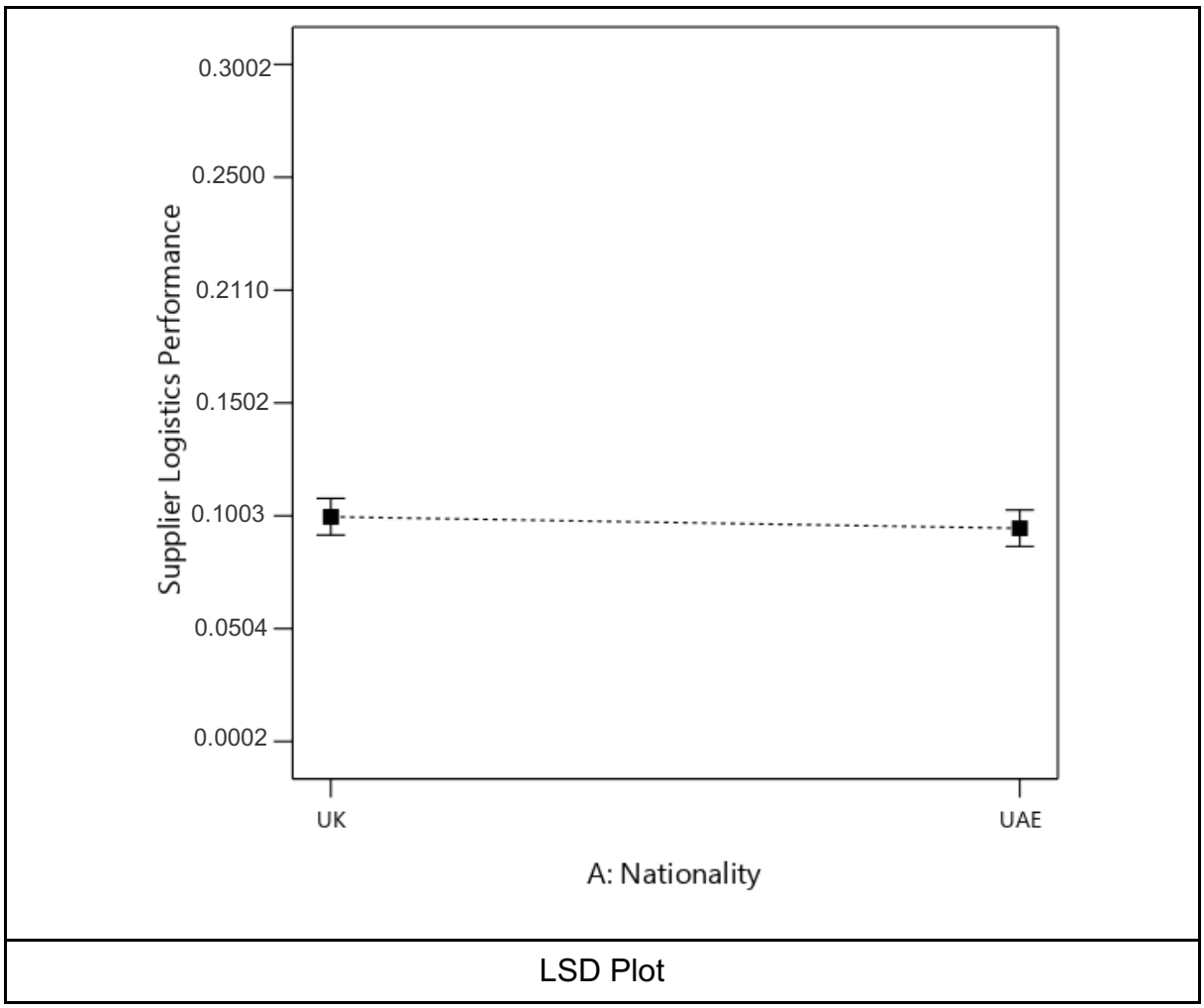


Figure 4.18 The Least Significant Difference Plot for Supplier Logistics Performance

The above models show that ANOVA can be trusted and validated. Thus, it can be concluded that the supplier logistic performance criterion is evaluated equally by decision makers from the UAE and the UK in supplier selection, especially in the construction industry.

Overall, the above findings show that supplier selection decision makers in the UK and UAE have some similar and some different criteria, even at the sub-criteria level. The results also delineate the impact of cultural influence on decision-making. The details of the results are shown in the following table

Table 4.10 Comparison of the UK and UAE's Main Criteria and Sub-criteria

	UK				UAE			
Criteria	Rank of main criteria	First important Sub-criteria	Second important Sub-criteria	Third important Sub-criteria	Rank of main criteria	First important Sub-criteria	Second important Sub-criteria	Third important Sub-criteria
Supplier Experience	**3**	Supplier expertise	Marketing position	Performance history Reputation Innovation Amount of past business	**4**	Performance history and delivery	Repetition Innovation and Creativity	Supplier expertise Marketing position Amount of past business
Supplier Financial Position	**1**	Financial stability Warranty	Cost and price	Desire for business Quantity discount	**2**	Financial stability	Cost and price	Warranty Desire for business Quantity discount
Communication and Responsiveness	**8**	Ability to fill emergency orders Customer service	Process flexibility	Response to Change	**3**	Ability to fill emergency orders	Process flexibility Response to Change	Customer service
Supplier Quality Management	**2**	Quality system Quality of support service	Meeting regulation requirement	Reliability Production facilities and capabilities Organisational leadership	**1**	Quality of support services Quality system Meeting regulation requirement	Reliability Production facilities and capabilities	Organisational leadership

Supplier Process Performance	**7**	Process capability	Process improvement Tech. system Manufacturing capability	Bidding procedure	**7**	process capability Tech. system	Future manufacturing capability	Bidding procedure Design/process improvement
Supplier Cultural Factors	**9**	Patriotism to same Cultural and Beliefs	Location Admire to History and Heritage		**9**	Patriotism to same cultural and beliefs	Location, Locally or Foreign	Admire to History and Heritage
Supplier Green Practice	**5**	Green Technology/ operations	Green Certifications	Green Procurement Waste Disposal Schemes	**5**	Green procurement	Waste Disposal Schemes	Green Technology/ operations Green Certifications
Cooperate Social Responsibility (CSR)	**4**	Environmental sustainability	Economical Sustainability Social Sustainability Ethical behaviour	Philanthropic responsibility	**8**	Ethical behaviour Environmental sustainability Economical Sustainability	Social Sustainability	Philanthropic responsibility
Supplier Logistics performance	**6**	Hazardous Post-production configuration	Location Geographical distance	Packaging	**6**	Geographical distance Hazardous	Post-production configuration Location	Packaging

The above table summarises the way that UK and UAE decision makers define the sub-criteria under each criterion. The first column of the table presents the main criteria, followed by a column that specifies the rank of this criterion according to its importance relative to each decision maker, whether from the UK or the UAE. The sub-criteria are then split into three categories, namely the first (most) important, the second most important and the third most important.

4.3 Discussion

This research aimed to establish whether there were differences between Emirati and British purchasing decision makers in terms of the factors or attributes of suppliers that influence their purchasing decisions. This was achieved through the development of a framework based on the literature, theories and mathematical foundations to evaluate differences in supplier selection decision-making between UK and UAE managers. The development of this model considered several suitable MCDM techniques.

The decision criteria were derived from the review of the literature. The commonly accepted attributes of supplier selection were included in the current research framework alongside new supplier criteria: cultural and national factors, green practices and CSR. Although these factors have been considered before in different supplier selection models, there were limited supplier selection models that addressed all the identified criteria collectively. There was an assumption in this research that there were other attributes of suppliers that could influence purchasing decisions that had not been previously considered in supplier selection criteria. This was based on the idea that culture could influence the decisions that are made regarding suppliers. Importantly, the current research included a cross-cultural consideration as it compared two different countries from diverse cultures – the UK and the UAE. It should be noted that a high degree of similarity between the two groups was found.

Overall, the results show that there were both similarities and significant differences between the two groups in terms of the importance of selection criteria. The results were presented in ranking of importance of the main criteria

ranging from ‘1’ to ‘9’, with ‘9’ being the least important. The sub-criteria were ranked according to first, second and third levels of importance.

4.3.1 The Important Selection Criteria

From the results of the current research, it is clear that there is a difference in the decisions made by UK and UAE buyers about supplier financial position and quality management. It was found that these criteria were the most important for both groups. The financial position was the most important criterion for the UK decision makers, followed by quality in second place. Conversely, quality was most important for the UAE decision makers, followed by financial position in second place.

These results agreed with much of the literature about supplier criteria, where quality is the most important criterion followed by financial cost (Zimmer et al., 2016). However, the high level of importance attributed to quality by the UAE managers in this research contradicts some research that revealed the existence of negative attitudes in the UAE towards total quality management (Mansour & Jakka, 2013). This can be attributed to the fact that decision makers in the UAE are more concerned about their suppliers applying the quality management techniques and systems than applying them themselves. Quality is a necessary consideration because it affects the functioning and efficiency of the pre-established measures that are instituted to achieve optimality, as suggested by institutionalisation theory.

For the UK decision makers, financial position was the most important criterion when choosing their suppliers. This includes cost incurred in acquiring supplier products, which are considered in the literature to be the most important concerns for the purchase decision makers (Cengiz et al., 2017; Pal et al., 2013) because they are closely associated with savings (Chang et al., 2011) and competitiveness (Dargi et al., 2014). Such an approach is informed by the need to mitigate operational costs and hence realise more profit from internal and external processes. It is important to consider the nature of the decision-making organisation. Organisations that more actively embrace the use of technology are more likely to view cost as being highly important because the resource demands

continuous maintenance and customisation, which may be costly and detrimental in the long run (Clavareau & Labeau, 2009). The present research involves the construction industry, which purchases technology. Furthermore, construction projects are mostly restrained by cost and time considerations (Olawale & Sun, 2010).

4.3.2 Decision Similarities

For a number of the main criteria, there was agreement between the two groups about their importance. Specifically, there was agreement about the importance of supplier green practices, ranked at 5th out of the nine criteria. According to the results, although there was a difference in the decisions made by the UK and UAE buyers over the supplier green practices sub-criteria, both ranked the main criterion as 5th. Similarly, for the supplier process performance, both ranked it 7th out of the nine criteria. Supplier logistics performance was ranked by both as 6th and the supplier cultural criteria were ranked in 9th position. These findings contradict some of the literature that has reported differences in national cultures and supplier selection. For example, Carter et al. (2010) highlighted that decision makers from different national cultures do not make similar business decisions. Carter et al. (2010) also noted that, based on this contention, each organisation needs to consider the specific internal and external environmental factors which transcend the linearity of culture in the identification of efficient business models to realise continuity. Such reality is important as it augments the efficiency of the steps that have been undertaken to ensure that the supply chain indeed meets the needs of the organisation at different stages of production.

This research has revealed definite trends in the supply chain criteria concept. For example, the agreement between the two groups on several criteria, and the little importance given to cultural attributes in the UAE shows that the supply chain management administrative personnel, that comes from a cultural background founded on religious and tribal affiliation, is paying less attention to the culture and focusing on merit. Therefore, this could be an acknowledgment of the fact that the organisational culture in the construction industry in the UAE as it explained by Wu and Jia (2018), El-Said (2013) and Cai et al. (2010). Meanwhile, it is important that in general, UAE has been structured to reflect western supply

chain selection values. It would be reasonable to expect that there is merit in this idea because the UAE depends heavily on an outsourced workforce, at both the management and unskilled labour levels, and therefore there would be an influence on the institutional supply chain practices across the two regions.

The following paragraphs show the criteria that were agreed upon by the decision makers from both the UK and UAE regarding their supplier selection.

(a) Supplier Process Performance: The supplier process performance was found to be equally unimportant for both UK and UAE decision makers when choosing suppliers. In the literature, the capability of suppliers is an attribute of suppliers considered in supplier selection in the construction industry (Patil et al., 2016). Also, technical capability has been one of the most important selection criteria for many decades and has become more important in more recent times (Aguezzoul, 2011). Furthermore, manufacturing capability has had the same level of impact as financial position (Aguezzoul, 2011) and process capability indices have been used extensively in supplier selection (Yen & Pearn, 2009). A similar inference is captured by Krause et al. (2007), who argued that supplier selection affects the rapidity and sustainability of production in ensuring that the needs of the target market are met. However, in contrast to the previous works, the current research found that both UK and UAE decision makers gave relatively little importance to supplier process performance, ranking it 7th out of nine criteria when choosing suppliers. This does not mean that this criterion is less important for both, but it is less important than other criteria available in the current research framework.

(b) Supplier Logistics Performance: The results of this study showed that both UK and UAE procurement managers (buyers) felt that supplier logistics performance possesses moderate importance when choosing suppliers – it was ranked as 6th out of the nine criteria. This conclusion agrees with the research presented by Wang and Zhong (2009), which highlighted the importance of the technical capability of the supply chain in supplier selection.

(c) Supplier Experience: Historically, supplier experience has been claimed to be one of the most important attributes of a supplier (Chen, 2011), and for the UK decision makers this was shown to be the case, as it was ranked 3rd

out of the nine criteria. However, it was a slightly less important attribute for the UAE decision makers when choosing suppliers, as they ranked it 4th out of the nine criteria. The difference was only small, so it can still be said that the two different groups (UK and UAE) decision makers were close in their opinions of the importance of supplier experience when making decisions regarding supplier selection. However, considering the sub-criteria within supplier experience, expertise was found to be the most important sub-criterion for UK decision makers but less important for the UAE decision makers. This is because performance history and delivery are the first criteria that the UAE decision makers considered when defining the supplier's experience. The difference shows that decision makers from the UK and UAE define supplier experience differently.

(d) Supplier Cultural Factors: One of the premises of this research is that cultural differences could influence the perceived importance of selection criteria and that supplier selection could be influenced by the cultural attributes of the supplier. This was hypothesised because one of the cultural groups under consideration in this study, the UAE decision makers, is known to have cultural attributes including religious, cultural and tribal affiliations and loyalties (de Waal & Frijns, 2016). However, the results of this study revealed that cultural factors associated with the supplier were the least important criteria for both decision-making groups. One of the reasons noted in the current research is the impact of globalisation. Globalisation is currently affecting the entire business environment. This makes culture less important in the manufacturing and supply chain environments. Similarly, buying companies are no longer wary of suppliers from different cultures or those who possess different norms and beliefs. The companies are just focusing on the suppliers that meet their requirements, have a stable financial position and can deliver without any delays. Therefore, the individual cultural differences reflected by the suppliers do not interfere with the analysis of the overall cultural values that affect the different communities in supply chains.

The only sub-criterion of the supplier cultural factors that was recognised and employed by the supplier decision makers is patriotism. Even though the main criterion was ranked the lowest, both UK and UAE purchase decision

makers ranked a sense of patriotism as the most important sub-criterion of supplier cultural factors. This concurs with the literature, where it has been shown that there is a desire to purchase domestically (Becker & El-Said, 2013, p. 91) and a preference for patriotism in purchasing decisions (Rose, 2001). Furthermore, the idea of supporting local industries in the supply chain is not prevalent in the UAE, which results in lower stakeholder engagement as a result of national uniformity (Noeiaghaei, 2009, p. 78).

The UAE is an Islamic country and many of the purchase decision makers in this study are affiliated to the Islamic religion. It has been shown that religious affiliation and family/ideological loyalties can be stronger than the sense of patriotism in the Gulf region (de Waal & Frijns, 2016). Furthermore, it has been claimed that there is a hostile business environment in the UAE, which has been attributed to the strong influence of religion, strong family and tribal affiliations, and the idea of 'Wasta' (Wasta refers to nepotism and gaining favours because of people you know, often between families or tribes) (de Waal & Frijns, 2016). However, the results of this study have shown that these cultural and religious, or even tribal, attributes of the supplier do not have a significant impact on UAE purchase decision makers, although they are from a region where religious, cultural and tribal affiliations are known to be strong. This enforces the fact that decision makers from the UAE are becoming more sensitive to global cultural dynamics and more tolerant and mature.

The above argument also reinforces the point that supplier decision makers from the UAE are currently focusing on organisational profit-making, rather than such elements as cultural, religious or tribal affiliations of the supplier when making decisions regarding supplier selection. The result contradicts the findings of Livanis et al. (2016), who found that buyers in a developing country (in this case Saudi Arabia, a country culturally similar to the UAE) prefer suppliers from other developing countries that share common cultural attributes, including religion. However, Darrat (2011) explained that purchasing animosity is a geopolitical problem that has affected purchasing decisions in the Middle East. This scholar explained that companies in the

region prefer to buy from suppliers that originate from the region. Therefore, it should not be assumed that cultural similarity and familiarity will necessarily positively affect the purchasing decision. In reflecting on the immensity of the cultural element, Piron (2000) argued that such familiarity needs to be complemented with other factors, such as cost, in ensuring that purchasing decisions are streamlined. Essentially, the element of cultural familiarity is not the ultimate decision maker in influencing the purchasing decisions made by individuals in the same consumer communes.

Furthermore, the result shows that the UK decision makers also found this sub-criterion the least important. There is little evidence that UK decision makers (managers) are influenced by the cultural attributes of suppliers; it is more likely that they are influenced by cost and quality.

Overall, the business environment in the UAE has been said to be influenced by religion, globalisation, and culture, or a combination of these factors. In fact, Islam has been shown to have the greatest effect on behaviour in these countries (de Waal & Frijns, 2016). However, much of the literature that considers these influences is related to workplace behaviour, leadership styles, organisation performance and effectiveness, and job satisfaction. There is no consideration of the influence of religion, culture, and globalisation on decision-making when selecting suppliers. This result suggests that these factors are certainly not important in the supplier selection process, specifically concerning having shared religious, cultural and tribal affiliations. However, the results do suggest that globalisation has been an influencing factor, as both UK and UAE managers feel the same way about the unimportance of supplier cultural factors.

The results show that the UK decision makers, despite considering supplier cultural factors as being the least important, viewed all of the sub-criteria as being equally important. This contrasted with the UAE decision makers, who viewed patriotism for the same culture and beliefs as the most important. This highlights the fact that the UAE decision makers recognise solely the importance of the sub-criterion patriotism for the same culture and beliefs,

because people from the UAE think positively about patriotism and they have strong attachments to their culture and beliefs.

In particular, Alyousif et al. (2010) established that in the construction industry in the UAE there is a mixed management style based on national and Islamic culture. This style also includes Arab pride, tribal and family affiliations, and religious beliefs as internal factors, as well as globalisation, the requirements of advanced technology, and the influence of expatriate culture as external factors. This style may aid in explaining the results of the current research. While the UAE managers, who were UAE citizens, may have had cultural and religious affiliations, the external factors, especially the influence of expatriate management from the West, could make them put lower importance on cultural factors during supplier selection. Because the construction industry in the UAE (as well as other industries in the UAE and other oil-producing countries in the region) has a large number of expatriate managers from western countries, this has influenced attitudes and practices. In other words, the western management of UAE construction companies masks any cultural effect that might be present within UAE managers with Arab citizenship. Furthermore, the UAE, in general, has a very high expatriate population. Arab nationals only account for about 15% of the total population and a significant number of expatriates come from western countries, such as the UK and USA (de Waal & Frijns, 2016).

Another sub-criterion that is closely associated with loyalty and patriotism is the supplier's operational base in terms of being local or foreign. For the UAE managers, this sub-criterion was considered to be the second most important, in comparison to UK managers who felt that it was the most important. Carter et al. (2010) showed cultural differences for several different criteria that were relevant to source location, and although it may be argued that some of these criteria, such as costs, flexibility, and fulfilling customer orders, have also been addressed in the current research, most of them relate to location and include local politics, government corruption, political stability, protection of property rights and infrastructure.

The outcome of this research also revealed that the UK decision makers valued the location of the supplier, whether local or foreign, as the location has cost or even logistical effects on the overall bought supplies. It is not very surprising that the UAE decision makers did not admire the history and heritage of the supplier when choosing a supplier, contrary to UK decision makers. This is due to historical differences between the two nations

(e) Green Practices: Environmental sustainability is an important part of organisational responsibilities and this sub-factor was found to be prioritised by both UK and UAE decision makers. This is reflected, in the fact that both of the decision-making groups ranked supplier green practices in 5th place in order of importance out of the nine criteria. This suggests that UK and UAE decision makers have a similar ethical culture, which has an impact on how management consider environmental criteria, as claimed by Goebel et al. (2012). The overall ranking of 5th for supplier green practices is expected, because priority is still given to suppliers' costs and efficiency. It is also important to understand that when suppliers are efficient, this can translate into environmental benefits. A similar inference is made by Gurel et al. (2015), who argued that environmental sustainability goals influence supplier selection processes globally.

4.3.3 Decision Discrepancies

The current research noticed that there were two criteria that had contradictions between the two groups of decision makers (UK and UAE) about supplier selection. These are CSR and Communication and Responsiveness. These are considered here against possible explanations for these conflicts about the literature and in the case of CSR, the legal and regulatory frameworks in the respective countries.

(a) Corporate Social Responsibilities: There was a huge difference in the importance of CSR to the UK and UAE decision makers. For the UAE decision makers, it had very little importance, even though CSR is seen as an important attribute because it is important for the reputation of the organisation (Moghaddam, 2015), and generally is a major concern for most

organisations. It is not just a matter of reputation, but neglecting CSR can lead to loss of revenue (Chen & Baddam, 2015) through a perception of unethical behaviour (Goebel et al., 2012). Therefore, the results of this study for the UAE decision makers deviates from the prevailing business dynamics which suggest that CSR is a compelling concern. The UAE decision makers valued the presence and application of CSR, but they did not think that having high CSR would increase suppliers' chance of being chosen. Also, ranking CSR at the end of the list for importance does not mean that CSR is not important to the UAE decision makers, just that they viewed it as less important than other criteria. In reflecting on the criticality of CSR in influencing the supply chain selection process. Chiouy, Chou & Yeh (2011) suggested that it does play a crucial role in western and European settings. Nonetheless, this may not be replicated in the UAE because of the differences in the economic models that are reflected in the two countries.

The UK decision makers considered CSR to be much more important – they ranked it in 4th place. These results could reflect national regulatory and legal standards. The UK has a well-established regulatory framework for CSR, for example, the following acts and regulations:

- Working Time (Amendment) Regulations 2001
- Race Relations Act (Statutory Duties) Order 2001
- Disability Discrimination Act 1995 (2005)
- Maternity and Parental Leave (Amendment) Regulations 2001
- Employment Act of 2002
- Health and Safety at Work Act 1974
- Companies Act 2006

This legal and regulatory framework is reflected in the UK decision makers' consideration of the importance of CSR. Therefore, it might be reasonable to deduce that the lack of importance attributed by the UAE decision makers to CSR is reflective of a less established legal and regulatory CSR framework in the UAE. However, the results of this study are unexpected because CSR is certainly something that is becoming more important in the UAE – for example, a new CSR law came into force in February 2018. However, it may

be the case that this law is taking some time to come into effect. The new law requires that contributions to CSR activities are declared and there are incentives for participation in CSR activities. Meanwhile, these are recent developments, and more historically, the business environment and the community have not prioritised CSR initiatives in the UAE (Noeiaghaei, 2009), which could be an explanation for the low importance attributed to CSR.

Furthermore, although there is now greater awareness of CSR in the UAE, the emphasis on complying with mandatory legislation, both social and environmental, is limited. Similarly, there is less concern about legislation that is not mandatory and there is a need to promote contribution to community activities (Al Tamimi & Hussein, 2014). These explanations might have been reflected in the results of the present research concerning CRS and its sub-factors. The results show that for UAE decision makers, environmental and economic sustainability was more important than philanthropic responsibility. In reference to philanthropic responsibility, the results of the current research disagreed with the literature, because Islam is an influencing factor and part of the Islamic work ethic is generosity and justice in the workplace, as explained by de Waal & Frijns (2016). However, this is the case at a personal level (due to religious, mainly Islamic, obligations) and not at the corporate organisational level.

Regarding the construction industry in the UAE specifically, the reporting of sustainability practices is low in comparison to other industries (Raajeev, 2017). This is also very poor in comparison to the global average. For example, in 2017 only 12.5% of UAE construction companies reported sustainability activities in comparison to 68.7% reported globally (Raajeev, 2017). This would explain the much higher allocation of importance to supplier CSR practices by the British decision makers in comparison with the UAE decision makers. However, other reporting practices for CSR in the UAE construction sector have shown that there is a 100% reporting rate for human resources and sustainability, and 100% of companies in the sector were

aligned with global sustainability, which was higher than the global average (Raajeev, 2017).

(b) Communication and Responsiveness: One of the major inconsistencies in the findings between the two groups was the importance of the communication and responsiveness of the supplier during the supplier selection process. It was of very little importance to the UK decision makers, ranked 8th in terms of importance, but was considered important by the UAE decision makers, ranked 3rd out of the nine criteria. This research has assumed that cultural differences are relevant to the consideration of supplier attributes, and this should be considered here.

The UAE decision makers placed considerable importance on communication and responsiveness, which came 3rd after financial position and quality. The literature also suggests that order fulfilment, a major part of this criterion, is as important as cost (Tracey & Tan, 2001) and second only to quality (Dey et al., 2015). Today's business environment is both competitive and always changing. Companies need to respond to sudden changes that are presented in the marketplace. This is only possible with a responsive and flexible supplier, and a great deal of importance has been placed on this in the literature for these reasons (Christopher & Juttner, 2000; Gunasekaran, 1999; Naylor et al., 1999; Upton, 1995; Yusuf et al., 1999). However, according to Albaloushi and Skitmore (2008), awareness of supply chain integration and its associated methods in the construction industry is relatively low, especially in developing countries such as the UAE. As time passes, and with increasing awareness of supply chain integration in the UAE, the importance of the communication and responsiveness criteria will increase for UAE decision makers.

Further contradictions are found in the results of this study, where the UK decision makers placed the least importance on 'response to change' as a sub-criterion. It was expected that the UAE would place less importance on response to change, but not the UK. Hence, there might be significant cultural or contextual reasons for the vast difference in the perception of the importance of this sub-criterion between the UK and UAE decision makers.

It is important to note that different types of decision makers participated in the current research, including supply chain managers, purchasing managers, and operations managers. Thus, given their position and their responsibility, they might have varying understandings of the importance of communication and responsiveness. For example, supply chain flexibility includes volume flexibility, distribution flexibility, product flexibility and responsiveness flexibility (Vickery et al., 1999). This flexibility might well be understood by the supply chain manager but not completely understood by logistic managers who focus on distribution flexibility. Thus, it should be expected that different roles in different organisations would prioritise different types of flexibility. Therefore, in understanding the diverse results between the UK and UAE decision makers, there needs to be consideration of these factors.

4.4 Answering the Research Questions

From the results and discussion of the results, it can be deduced that the research questions of the current research are answered.

The first research question asked: ***What are the key selection criteria for suppliers in the construction industry in the UK and UAE?*** This question assumed that there were many selection criteria for suppliers, as argued by Azadfallah (2017), Kannan and Tan (2006), Tracey and Chong (2001), Dickson (1966) and many other scholars. These scholars focused on different industries. In some cases, such as Tracey and Chong (2001) and Dickson (1966), their criteria are general. This implies that the provided criteria might not be important in a specific sector or industry. Therefore, the current research investigated the most important criteria for construction companies. The research found that supplier financial position and quality management are the most important criteria in the construction industry in the UK and UAE, respectively. This finding is premised in the work of Cengiz et al. (2017), Dargi et al. (2014), Pal et al. (2013) and Chang et al. (2011).

The second research question was: ***Do the cultural factors of the UK and UAE affect the supplier selection criteria and selection decision-making?***

Although the scholars, Chai and Ngai (2020), Guarnieri and Trojan (2019) and Carter (2005) stated that there is a cultural influence in the selection of suppliers, these scholars did not specify how culture influences selection decision-making. Besides, these scholars did not use the case of the construction industry. Thus, this research examined how culture affected supplier selection. The outcomes of this research confirmed that there is a cultural influence on supplier selection, but it is not boldly stated by decision makers. The current research found that patriotism is the main cultural factor that affects supplier selection in the construction industry in the UK and UAE.

The last question was: ***What kind of mathematical model can be used for supplier selection criteria in the UK and UAE construction industry?*** There are many mathematical models propounded by some scholars, such as Thanki et al. (2016), Beikkhakhian et al. (2015) and Saaty (1980). These models did not focus on the construction industry. Thus, the current research examined different models and found that the AHP model could be useful for the construction industry. The AHP was applied to the current research framework. Then, a model from Bello (2003) and Saaty (1980, 1990) was used to develop a mathematical formula based on the current research framework criteria and sub-criteria and the weights derived from the AHP outputs. This formula can be used to find the overall score of a supplier in any construction company located in the UAE or UK and their regions. When applying this formula, the decision maker has the right to exclude any criteria or sub-criteria based on their requirements and needs. It will offer quick decision-making and reduce the time and effort during the supplier selection process.

CHAPTER 5: CONCLUSION AND FUTURE WORK

In this chapter, the main arguments of this thesis are combined and the significant conclusions that have been reached are presented. The contributions of this research are also presented, as well as its implications, the research limitations, and recommendations for possible future research.

5.1 Conclusion

The availability of several scholarly articles on the current research topic shows that scholars have been discussing it for decades. The work of Dickson (1966) also shows that the choice of supplier selection criteria has been an important issue for decades. Similarly, recent works, such as Salam and Khan (2018), Rojniruttikul (2017), Trapp and Sarkis (2016), Polat and Eray (2015) and Waris et al. (2014), show that multiple selection criteria have sparked scholarly debates recently. Likewise, the works of Saaty (1980, 1990, 1996, 2001) and more recent works from Carter et al. (2010), Rogers (2009), Bello (2003) and Roshandel et al. (2013) show that developing models for supplier selection is among interesting research areas for scholars. Meanwhile, these previous works did not focus on the 'most important' selection criteria. The previous works also did not focus on the cultural influence of the supplier selection decision maker. Finally, the previous works have not yet considered the construction industry.

The aforementioned gaps propelled the current research. As shown in previous works, several criteria are needed. However, not all the criteria would be useful for every situation or every industry, as shown in the results of the current research. The current research revealed that some key criteria are relevant only to some supplier selection decision makers in a specific country, even they operate in the same industry. Similarly, the current research revealed that projects or products determine the most important criteria to be used for selecting suppliers. Thus, it can be concluded that identifying and focusing on the most important criteria is essential for supplier selection decision-making.

Although the previous works, which include Livanis et al. (2016), Carter et al. (2010), Liu et al. (2010), Chu and Spires (2008), Rose (2001) and Min (1994),

considered cultural factors in their studies and models, the current research found that there is a cultural influence in decision-making. The current research revealed that patriotism influenced supplier decision makers in the construction industry. Similarly, the current research pinpointed that cultural influence is beyond language, tribal affiliation, and religious beliefs. The current research noticed that cultures aspects are still hidden because decision makers do not want to discuss them. Meanwhile, the current research emphasised that patriotism and protection of cultural heritage might influence decision makers in the construction industry in selecting their suppliers. Hence, it can be concluded that the current research throws more light on the cultural influences on selection of suppliers.

Previous works have examined many industrial sectors, as shown in the work of Amorim et al. (2016) and Banaeian et al. (2016) for the food industry; Degraeve and Roodhooft (1999), Hirakubo and Kublin (1998) for the electronics industry; Dweiri et al. (2016), Gupta et al. (2015), and Shahroudi and Tonekaboni (2012) for the automotive industry; Feurtey et al. (2016) for the energy industry; Gustin et al. (1997) for software products; Rojniruttikul (2017) for motorcycle spare parts; and Sodenkamp et al. (2016) for the trading sector. Meanwhile, very few previous works considered the construction industry: Albaloushi and Skitmore (2008) for UAE construction, and Voordijk et al. (2000) for European cases. The current research investigated the construction industry from large economies in different regions. Therefore, it can be concluded that the current research contextualises scholarly discussion on supplier selection.

In respect to the above, it can be concluded that the current research has achieved its goal by identifying and prioritising the most important supplier selection criteria and sub-criteria related to construction organisations in the UK and UAE. It can be concluded that the current research attained its aim by identifying the similarities and differences in how the UK and UAE decision makers evaluated suppliers. Similarly, it can be concluded that the current research achieved its objective by outlining the effects of culture on the decision-making process of supplier selection. This research not only considered the

cultural attributes of the decision makers, but also the role of the cultural and nationalistic attributes of the suppliers.

The current research developed a mathematical model for evaluating and selecting suppliers in the construction industry. The model is based on a comprehensive literature review to find a suitable list of supplier selection criteria and sub-criteria relevant to the construction industry. The model also includes the traditionally accepted criteria, as well as new criteria such as CSR factors and factors associated with culture. The model is customisable. It can be customised to reflect on specific criteria that are under analysis and an effective mathematical model can be generated to test the pre-established criteria structure. Therefore, it can be concluded that the current research achieved its goal of providing or proposing a mathematical model for supplier selection in the construction industry.

The goals of the current research were achieved through a mixed research method. It collected its data from decision makers who have more than three years of working experience. These decision makers are working with large construction companies that have more than 1,000 employees and are presently engaging in mega construction projects in the UK and UAE. The collected data were analysed quantitively (thematic analysis) and quantitatively (AHP and ANOVA). Therefore, it can be agreed that the current research achieved its goals by following the scientific procedure explained by Voss (2010), Eriksson and Kovalainen (2008), Braun and Clarke (2006) and Yin (2002).

5.2 Contributions of the Current Research

Firstly, the current research provides the most important criteria for selection of suppliers in the UK and UAE. This information has not yet been provided by previous scholars and practitioners. Thus, this research contributes to a further understanding of the factors that influence the decision-making process in supplier selection in the construction industry. More specifically, the current research contributes the finding that the financial position, quality management, green practices, and supplier logistics are the key criteria in the construction industry in the UK and UAE.

Secondly, the current research contributes to the understanding of cultural differences and the potential role of cultural differences in the decision-making process. As a compelling contribution, the current research establishes the role of cultural influences in the supply chain selection process. This provides companies with the opportunity to identify at the inception of the decision-making process relevant stakeholders who can reflect the specific cultural demands. Such an intervention will serve the purpose of mitigating the confusion and time/cost capital that is engaged in the creation of the best supply chain networks. Furthermore, the current research offers an insight into the influences that the cultural and national attributes of suppliers have on decision makers from different cultural and national backgrounds.

Thirdly, the current research seems to be among the first comparative studies. It examined two large economies with diverse backgrounds (in terms of culture). It also applied a mixed method with several participants from the large companies. Its findings revealed the areas of similarities and discrepancies when making supplier selection decisions. All these make the current research contribute to a better understanding of supplier selection in SCM literature.

Fourthly, the current research introduced a mathematical model that can enable scholars to understand the importance of different selection criteria. This model can also enable practitioners to rank their selection criteria. The model contains the main criteria and sub-criteria. The model can facilitate supplier selection decision-making. Thus, the current research contributes to the scholarly models of SCM.

Fifthly, the current research introduced a list of main and sub-criteria that can be used in selecting suppliers in the construction industry. The list was based on previous scholarly works. This effort reduces fragmentation in the literature and contributes to the state-of-the-art knowledge in SCM.

Lastly, the current research employed TCT, institutionalisation and agency theories to the discussion of supplier selection. The combination of these is not commonly used in SCM scholarly works. The application of these theories

enriched the current research. Therefore, it can be agreed that the current research contributes to the theory and practices of SCM.

5.3 Implications of the Research

This research is beneficial for suppliers and purchasing decision makers, not only in the construction field in the UAE and the UK but also for other business organisations. The list of most important selection criteria in the construction industry enlightens suppliers on how they can build up their profile. The suppliers of construction materials, products and services in the UK and UAE can now focus on their profile, so that they can meet their clients' selection requirements. For instance, UK suppliers can seek to improve their financial position, quality management, green practices, and logistics management. If these suppliers can uplift their profile, they might have a high probability of being selected by construction companies in their country. Similarly, the list encourages decision makers to speed up their selection process. For instance, UAE purchasing decision makers can now rank their potential suppliers in a list by focusing on their quality management, financial position, and waste disposal practices.

The list of the current research framework classifies the areas that should be focused on to achieve success in any project. From the perspective of the decision maker, the results create a clear image of the most important criteria to be considered in the process of supplier selection and how to evaluate the supplier in a more accurate way to ensure project success and completion on time. From the perspective of the supplier, the research contributes guidance about what they should focus on when they are dealing with an organisation based in the UK or the UAE. Such guidance will enable suppliers to fulfil decision makers' requirements and also to ensure that they are awarded the contract during the bidding process.

Furthermore, the current research has implications for other businesses. The list of the current research enlightens different business organisations to outline different key criteria and define the sub-criteria of these criteria. This process will undoubtedly facilitate the recruitment, assessment, and selection of their

suppliers. Similarly, the mathematical model developed by the current research can be used to recruit, evaluate and select the best suppliers.

The research also has implications for other academics and professionals who are interested in the role of culture in the decision-making process. The UK is often referred to as the eighth Emirate because of the close business and political ties between the two countries (Al Qassemi, 2010). Therefore, this research has implications for those practitioners involved in this type of relationship. The fact that culture was found to be almost equally unimportant for both management groups has implications for assumptions that are made about culture in the UAE. Specifically, it is often assumed that tribal and religious affiliations exist in the supplier selection process, but this research has shown otherwise. Therefore, there are implications for those who are interested in the changing of attitudes and possible influences from the West or a globalised world. The idea of globalisation refers to another implication of this research – that globalisation has possibly reduced the influence that culture has in the purchasing decision-making process.

5.4 Limitations of the Research

One of the limitations of this research is that the sub-criteria were bound to the main criteria. This created a complete dependency of the sub-criteria on the main criteria. For example, the criterion of Supplier Cultural Factors included the sub-criterion of patriotism. However, although patriotism was found to be the highest within this criterion, it cannot truly be compared in terms of rank with other sub-criteria from other parent criteria because it is inextricably linked to its main criterion. Moreover, this research used just nine main criteria and 44 sub-criteria related to supplier selection. Thus, the list of criteria could be expanded to achieve a more comprehensive framework by reviewing more literature.

Another limitation was the research participants. Even within the same company, the decision makers surveyed had different technical backgrounds, and this was not taken into consideration when making priority calculations. Similarly, the participants had different previous working experience. This might influence their responses or interview answers. This was also not considered in the developing

framework and model for the current research. If these issues were considered, the current model might be changed.

There were difficulties in arranging the personal interviews, as they were conducted with managerial-level employees and the nature of the questionnaire questions (pairwise comparison) was not easy to understand and had to be explained to the interviewees before they answered the questions. This meant that data collection took a very long time to complete; more than seven months. These challenges influenced the outcome of the current research, though they did not reduce the quality of the findings.

The scope of culture in the current research is a limitation. The scope was limited to the external social values within a given society. It did not take into account the influence of corporate culture, which is an inescapable cultural factor in the decision-making process. Corporate culture is reflected in how a company is trying to build a functioning supply chain network. Meanwhile, these issues were supposed to be considered so the in-depth understanding could be attained.

The current research was also limited by its context – the construction industry in the UK and UAE. This limit resulted in generalisation of the framework and model of the research. The application of the model might have error, especially in its integration into a different industry. Essentially, since only two countries were considered for the research, it may not be feasible to generalise the findings across more countries.

Meanwhile, the above limitations do not affect the quality of the current research. The limitations provide opportunities for future studies that are presented in the following subsection.

5.5 Future Research

The nature of organisational culture affects decision-making, a future study can consider both organisational and national cultural factors in supplier selection decision-making. As a complement to the corporate culture of the decision maker's organisation, the nature of the customers of the purchasing organisation should be a consideration in a future study about the impact on purchase

decisions. This idea is supported by the fact that the nature of the customer is a very important influencing factor on the perceived importance of quality by purchasing decision makers (Asadabadi, 2017; Fallahpour et al., 2017). Similarly, future research can examine how personal traits and national attributes of the individual decision makers and suppliers influence their selection decisions in different industries. This would provide more insight and a better understanding of the cultural influence in the supplier selection process.

The current research acknowledges the potential expatriate influence in the UAE. Specifically, some of the expertise found in the UAE has been the result of engagement with an expatriate community. In fact, expatriate managers are often employed for their expertise and experience. The current research considered the differences in the preferences of selection criteria between the two countries. A future study could consider the implications of the presence of an expatriate workforce in the UAE for the considered importance of selection criteria. The results of this research have shown that there are both similarities and strong differences in the selection criteria and a future study could reveal the reasons for this. A future study could investigate whether the agreement between the two management groups is a result of expatriate influence in the UAE.

In consideration of the findings for patriotism, which was found to be unimportant, a future study could consider the implications for patriotism of the presence of expatriate management in construction organisations in the UAE. This is pertinent because this research found that for a country that has been shown to have strong cultural, religious and tribal affiliations, little importance has been given to patriotism. Therefore, a future study could consider the expatriate influence on this situation.

The same finding, that the cultural attributes of suppliers were equally unimportant for both groups, is a phenomenon that may also exist between other national contexts. Therefore, future research could investigate the importance of the cultural attributes of suppliers in other cultural contexts, aiming to reveal whether this is a phenomenon particular to the UK and UAE or not.

Regarding the issue that the sub-criteria are inextricably linked to each of the main criteria, a future study could allow the factors that have been considered as sub-criteria in the current study to be addressed individually. Patriotism, for example, could be assigned a level of importance beyond the restriction of its parent criterion, and therefore, be compared with all other supplier attributes.

Future studies could consider a comparative study between decision makers from the UAE and other western countries that have less of a relationship with the UAE business ecosystem. Finally, a future study could examine the effect of the decision maker's technical background on supplier selection decisions. The managers in this study had different backgrounds and expertise, and this needs to be considered in future research.

BIBLIOGRAPHY

Aamodt, A., & Plaza, E. (1994). Case-based reasoning: Foundational issues, methodological variations, and system approaches. *AI Communications*, *7*(1), 39–59.

Adebanjo, D., Ojadi, F., Laosirihongthong, T., & Tickle, M. (2013). A case study of supplier selection in developing economies: A perspective on institutional theory and corporate social responsibility. *Supply Chain Management: An International Journal*.

Aguezzoul, A. (2011). Overview on supplier selection of goods versus 3PL selection. In *2011 4th International Conference on Logistics* (248–253). IEEE.

Akman, G. (2015). Evaluating suppliers to include green supplier development programs via fuzzy c-means and VIKOR methods. *Computers & Industrial Engineering, 86*, 69–82.

Al Qassemi, S. (2010). The other special relationship: the UAE and the UK. *The National*. Retrieved from https://www.thenational.ae/the-other-special-relationship-the-uae-and-the-uk-1.549898. [Accessed: 13–06–2019].

Al-Tamimi, H., & Hussein, A. (2014). Corporate social responsibility practices of UAE banks. *Global Journal of Business Research*, *8*(3), 91–108.

Albaloushi, H., & Skitmore, M. (2008). Supply chain management in the UAE construction industry. *International Journal of Construction Management*, *8*(1), 53–71.

Albano, G.-L., Calzolari, G., Dini, F., Iossa, E., & Spagnolo, G. (2006). Procurement contracting strategies. In Dimitri, N., Piga, G., & Spagnolo, G. (Eds.), *Handbook of procurement* (pp. 82–120). Cambridge University Press: Cambridge.

Albayrak, E., & Erensal, Y. C. (2004). Using analytic hierarchy process (AHP) to improve human performance: An application of multiple criteria decision-making problem. *Journal of Intelligent Manufacturing*, *15*(4), 491-503.

Albert, G., Musicant, O., Oppenheim, I., & Lotan, T. (2016). Which smartphone apps may contribute to road safety? An AHP model to evaluate experts' opinions, *Transport Policy*, *50*, 54–62.

Aleo Jr, J. P. (1992). Redefining the manufacturer-supplier relationship. *Journal of Business Strategy*, *13*(5), 10–14.

Alyousif, A., Naoum, S., Atkinson, A., & Robinson, H. (2010). National culture influence on management practices in the construction industry of United Arab Emirates. In *Proceeding on 26th Annual ARCOM Conference* (6–8).

Amindoust, A., Ahmed, S., Saghafinia, A., & Bahreininejad, A. (2012). Sustainable supplier selection: A ranking model based on fuzzy inference system. *Applied Soft Computing*, *12*(6), 1668–1677.

Amorim, P., Curcio, E., Almada-Lobo, B., Barbosa-Póvoa, A. P., & Grossmann, I. E. (2016). Supplier selection in the processed food industry under uncertainty. *European Journal of Operational Research*, *252*(3), 801–814.

Ansari, A., & Modarres, B. (1988). JIT purchasing as a quality and productivity center. *International Journal of Production Research*, *26*(1), 19–26.

APICS. (1999). *APICS Dictionary, Educational society for resource management*. Chicago: APICS.

Asadabadi, M. R. (2017). A customer-based supplier selection process that combines quality function deployment, the analytic network process and a Markov chain. *European Journal of Operational Research*, *263*(3), 1049–1062.

Avolio, B. J. (1999). Full leadership development: Building the vital forces in organizations. Thousand Oaks, CA: Sage Publishers.

Awasthi, A., & Kannan, G. (2016). Green supplier development program selection using NGT and VIKOR under fuzzy environment. *Computers & Industrial Engineering*, *91*, 100–108.

Ayhan, M. B., & Kilic, H. S. (2015). A two stage approach for supplier selection problem in multi-item/multi-supplier environment with quantity discounts. *Computers & Industrial Engineering*, *85*, 1–12.

Azadfallah, M. (2017). Multi criteria supplier selection using PROMETHEE outranking procedures. *Journal of Supply Chain Management Systems*, *6*(1), 24.

Azadnia, A. H., Saman, M. Z. M., Wong, K. Y., Ghadimi, P., & Zakuan, N. (2012). Sustainable supplier selection based on self-organizing map neural network and multi criteria decision making approaches. *Procedia-Social and Behavioral Sciences*, *65*, 879–884.

Bhagwat, R., & Sharma, M. K. (2009). An application of the integrated AHP-PGP model for performance measurement of supply chain management. *Production Planning & Control*, *20*(8), 678-690.

Bajari, P., & Lewis G. (2011). Procurement contracting with time incentives: Theory and evidence. *Quarterly Journal of Economics, 126*, 1173–1211.

Bala, V., & Van Long, N. (2005). International trade and cultural diversity with preference selection. *European Journal of Political Economy*, *21*(1), 143–62.

Banaeian, N., Mobli, H., Fahimnia, B., Nielsen, I. E., & Omid, M. (2016). Green supplier selection using fuzzy group decision making methods: A case study from the agri-food industry. *Computers & Operations Research*, *89*, 337–347.

Baptista, J., Newell, S., & Currie, W. (2010). Paradoxical effects of institutionalisation on the strategic awareness of technology in organisations. *The Journal of Strategic Information Systems*, *19*(3), 171–183.

Barla, S.B. (2003). A case study of supplier selection for lean supply by using a mathematical model. Logistics Information Management, 16 (6), 451–459

Barnham, C. (2015). Quantitative and qualitative research: Perceptual foundations. *International Journal of Market Research*, *57*(6), 837–854.

Bayazit, O., & Karpak, B. (2005). An AHP application in vendor selection. *ISAHP*, Honolulu, Hawaii, July 8–10.

Bechtel, C., & Jayaram, J. (1997). Supply chain management: A strategic perspective. *International Journal of Logistics Management, 8*(1), 15–34.

Becker, K., & El-Said, H. (2013). *Management and international business issues in Jordan*. London: Routledge.

Beikkhakhian, Y., Javanmardi, M., Karbasian, M., & Khayambashi, B. (2015). The application of ISM model in evaluating agile supplier's selection criteria and ranking suppliers using fuzzy TOPSIS-AHP methods. *Expert Systems with Applications*, 42, 6224–6236.

Beil, D. (2009). *Supplier selection*. Stephen M. Ross School of Business, University of Michigan, Michigan, USA.

Belassi, W., Cocosila, M., & Kondra, A. Z. (2017). The Effects of Organizational Culture on Buyer-Supplier Relationships in New Product Development. *International Journal of Business & Management Science*, *7*(2).

Bello, M. J. S. (2003). *A case study approach to the supplier selection process*. Master of Engineering. Management Systems Engineering, University of Puerto Rico, Mayaguez campus.

Belzer, M. H., & Swan, P. F. (2011). Supply chain security: Agency theory and port drayage drivers. *The Economic and Labour Relations Review*, *22*(1), 41–63.

Benton, W.C. (2010). *Purchasing and supply chain management*. 2nd edition. McGraw-Hill, Irwin.

Besikci, E., Kecceci, T., Arslan, O., & Turan, O. (2016). An application of fuzzy-AHP to ship operational energy efficiency measures. *Ocean Engineering*, *121*, 392–402.

Bhutta, K. S. & Huq, F. (2002). Supplier selection problem: A comparison of the total cost of ownership and analytic hierarchy process approaches. *Supply Chain Management*, *7*(3/4), 126–35.

Bottani, E., & Rizzi, A. (2008). An adapted multi-criteria approach to suppliers and products selection – An application oriented to lead-time reduction. *International Journal of Production Economics*, *111*(2), 763–781.

Bozarth, C. C. (2008). *Introduction to operations and supply chain management*. Pearson Education, Inc.: New Jersey.

Bradshaw, J., & Chang, S. (2013). Past performance as an indicator of future performance: Selecting an industry partner to maximize the probability of program success. *Defense Acquisition Research Journal*, *20*(1), 49–69.

Braglia, M., & Petroni, A. (2000). A quality assurance-oriented methodology for handling trade-offs in supplier selection. *International Journal of Physical Distribution & Logistics Management*, *30*(2), 96–111.

Brandenburg, M., Govindan, K., Sarkis, J., & Seuring, S. (2014). Quantitative models for sustainable supply chain management: Developments and directions. *European journal of operational research*, *233*(2), 299-312.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2): 77–101.

Burt, D. N., Dobler, D. W., & Starling, S. L. (2003). *World class supply management: The key to supply chain management*. Irwin/McGraw-Hill.

Büyüközkan, G., & Çifçi, G. (2011). A novel fuzzy multi-criteria decision framework for sustainable supplier selection with incomplete information. *Computers in Industry*, *62*(2), 164–174.

Cadden, T., Marshall, D., & Cao, G. (2013). Opposites attract: Organisational culture and supply chain performance. *Supply Chain Management: An International Journal*.

Cai, S., Jun, M. & Yang, Z. (2010). Implementing supply chain information integration in China: The role of institutional forces and trust. *Journal of Operations Management*, *28*(3), 257–268.

Carr, C. H., & Truesdale, T. A. (1992). Lessons from Nissan's British suppliers. *International Journal of Operations and Production Management, 12*(2), 49–57.

Carter, C. R. (2005). Purchasing social responsibility and firm performance. *International Journal of Physical Distribution & Logistics Management, 35*, 177–194.

Carter, J. R., Maltz, A., Maltz, E., Goh, M., & Yan, T. (2010). Impact of culture on supplier selection decision making. *The International Journal of Logistics Management, 21*(3), 353–374.

Carter, R. (1995). The seven Cs of effective supplier evaluation. Purchasing and supply management. *Journal of the Institute of Purchasing and Supply*, 44–45.

Causey, N. (2000). Past performance information, 'de facto' debarments, and due process: debunking the myth of Pandora's box. *Public Contract Law Journal*, *29*(4), 637–691.

Çebi, F., & Bayraktar, D. (2003). An integrated approach for supplier selection. *Logistics information management.*

Cengiz, A. E., Aytekin, O., Ozdemir, I., Kusan, H., & Cabuk, A. (2017). A multi-criteria decision model for construction material supplier selection. *Procedia Engineering*, *196*, 294–301.

Černá, L., & Buková, B. (2016). Supplier evaluation methodology in the logistics company. *Procedia Engineering*, *134*, 377–385.

Chai, J., & Ngai, E. W. (2015). Multi-perspective strategic supplier selection in uncertain environments. *International Journal of Production Economics*, *166*, 215–225.

Chai, J., & Ngai, E. W. (2020). Decision-making techniques in supplier selection: Recent accomplishments and what lies ahead. *Expert Systems with Applications*, 112903.

Chan, A. P., & Chan, A. P. (2004). Key performance indicators for measuring construction success. *Benchmarking: an international journal*.

Chan, F. T., Kumar, N., Tiwari, M. K., Lau, H. C. & Choy, K. L. (2008). Global supplier selection: A fuzzy-AHP approach. *International Journal of Production Research, 46*(14), 3825–3857.

Chang, B., Chang, C. W., & Wu, C. H. (2011). Fuzzy DEMATEL method for developing supplier selection criteria. *Expert Systems with Applications*, *38*(3), 1850–1858.

Chen, J., & Baddam, S. (2015). The effect of unethical behavior and learning on strategic supplier selection. *International Journal of Production Economics, 167*, 74–87.

Chen, Y. H., & Chao, R. J. (2012). Supplier selection using consistent fuzzy preference relations. *Expert Systems with Applications*, *39*(3), 3233–3240.

Chen, Y. J. (2011). Structured methodology for supplier selection and evaluation in a supply chain. *Information Sciences*, *181*(9), 1651–1670.

Chiouy, C. Y., Chou, S. H., & Yeh, C. Y. (2011). Using fuzzy AHP in selecting and prioritizing sustainable supplier on CSR for Taiwan's electronics industry. *Journal of Information and Optimization Sciences*, *32*(5), 1135-1153.

Choi, T. Y., & Hartley, J. L. (1996). An exploration of supplier selection practices across the supply chain. *Journal of Operations Management, 14*, 333–343.

Christopher, M. (2000). The agile supply chain. *Industrial Marketing Management, 29*(1), 37–44.

Christopher, M. (2010). *Logistics and supply chain management.* Financial Times/ Prentice Hall.

Christopher, M., & Juttner, U. (2000). Developing strategic partnerships in the supply chain: A practitioner perspective. *European Journal of Purchasing & Supply Management, 6*(2), 117–127.

Chu, P. C., & Spires, E. E. (2008). The Cost—Benefit Framework and Perceptions of Decision Strategies: A Comparison of China and the United States. *Journal of Cross-Cultural Psychology*, *39*(3), 303-308.

Clavareau, J., & Labeau, P. E. (2009). Maintenance and replacement policies under technological obsolescence. *Reliability engineering & system safety*, *94*(2), 370-381.

Coggburn, J. (2003). The differences in the American states' procurement practices. *Journal of Public Procurement, 3*(1), 3–28.

Construction Week Online (2015). *Construction to add 11.1% to UAE's GDP in 2015*. Retrieved from https://www.constructionweekonline.com/article-20183-construction-to-add-111-to-uaes-gdp-in-2015.

Cooper, M., Lambert, D., & Pagh, J. (1997). Supply chain management: More than a new name for logistics. *The International Journal of Logistics Management, 8*(1), 1–14.

Cousins, P. D., Giunipero, L., Handfield, R. B., & Eltantawy, R. (2006). Supply management's evolution: key skill sets for the supply manager of the future. *International Journal of Operations & Production Management*.

Cristea, C., & Cristea, M. (2017). A multi-criteria decision-making approach for supplier selection in the flexible packaging industry. In *MATEC Web of Conferences*, 94 (06002).

Danese, P. (2013). Supplier integration and company performance: A configurational view. *Omega*, *41*(6), 1029–1041.

Dargi, A., Anjomshoae, A., Galankashi, M. R., Memari, A., & Tap, M. B. M. (2014). Supplier selection: A fuzzy-ANP approach. *Procedia Computer Science*, *31*, 691–700.

Darrat, M. (2011). A conceptual investigation into the effects of cultural animosity on Middle Eastern consumers' purchase intentions. *Journal of Islamic Marketing*, *2*(1), 5–13.

De Boer, L., Der Wegen, L. V., & Telgen, J. (1998). Outranking methods in support of supplier selection. *European Journal of Purchasing and Supply Management*, *4*, 109–118.

De Boer, L., Labro E., & Morlacchi, P. (2001). A review of methods of supporting supplier selection. *European Journal of Purchasing and Supply Chain Management, 7*, 75–89.

de Waal, A., & Frijns, M. (2016). The influence of the UAE context on management practice in UAE business. *International Journal of Islamic and Middle Eastern Finance and Management*.

Degraeve Z., & Roodhooft F. (1999). Improving the efficiency of the purchasing process using total cost of ownership information: The case of heating electrodes at Cockerill Sambre S. A. *European Journal of Operational Research*, *112*, 42–53.

Deng, S., & Wortzel, L. H. (1995). Importer purchase behavior: guidelines for Asian exporters. *Journal of Business Research*, *32*(1), 41–47.

Deng, X., Hu, Y., Deng, Y., & Mahadevan, S. (2014). Supplier selection using AHP methodology extended by D numbers. *Expert Systems with Applications*, *41*, 156–167.

Dey, P. K., Bhattacharya, A., Ho, W., & Clegg, B. (2015). Strategic supplier performance evaluation: A case-based action research of a UK manufacturing organisation. *International Journal of Production Economics*, *166*, 192–214.

Dickson, G. W. (1966). An analysis of vendor selection systems and decisions. *Journal of Purchasing*, *2*(1), 5–17.

Doni, N. (2006). The importance of reputation in awarding public contractors. *Annals of Public & Cooperative Economics, 77*(4), 401–429.

Dubai Chamber of Commerce. (2012). *Construction Sector to Contribute 11.1% to UAE's GDP in 2015*. Retrieved from https://www.dubaichamber.com/whats-happening/chamber_news/construction-sector-to-contribute-11–1-to-uae%E2%80%99s-gdp-in-2015.

Dubey, R., Gunasekaran, A., Papadopoulos, T., & Childe, S. J. (2015). Green supply chain management enablers: Mixed methods research. *Sustainable Production and Consumption*, *4*, 72-88.

Dursun, M., & Karsak, E. E. (2013). A QFD-based fuzzy MCDM approach for supplier selection. *Applied Mathematical Modelling, 37*(8), 5864–5875.

Dweiri, F., Kumar, S., Khan, S. A., & Jain, V. (2016). Designing an integrated AHP based decision support system for supplier selection in automotive industry. *Expert Systems with Applications, 62*, 273–283.

Ellram, M. L. (1990). The supplier selection decisions in strategic partnerships. *International Journal of Purchasing and Materials Management, 26*(4), 8–14.

Erginel, N., & Gecer, A. (2016). Fuzzy multi-objective decision model for calibration supplier selection problem. *Computers & Industrial Engineering, 102*, 166–174.

Eriksson, P., & Kovalainen, A. (2008). *Qualitative methods in business research.* London: Sage Publications Ltd.

EU. (2008). *EU Annual report 2007*. Londre

Everard, M., Reed, M. S., & Kenter, J. O. (2016). The ripple effect: Institutionalising pro-environmental values to shift societal norms and behaviours. *Ecosystem Services*, *21*, 230–240.

Fallahpour, A., Olugu, E. U., Musa, S. N., Wong, K. Y., & Noori, S. (2017). A decision support model for sustainable supplier selection in sustainable supply chain management. *Computers & Industrial Engineering, 105*, 391–410.

Fayezi, S., O'Loughlin, A., & Zutshi, A. (2012). Agency theory and supply chain management: a structured literature review. *Supply chain management: an international journal*, *17*(5), 556-570.

Feurtey, E, Ilinca, A., Sakout, A., & Saucier, C. (2016). Institutional factors influencing strategic decision-making in energy policy: A case study of wind energy in France and Quebec (Canada*). Renewable and Sustainable Energy Reviews, 59*, 1455–1470.

Fine, C. H. (2000). Clockspeed-Based Strategies for Supply Chain Design 1. *Production and Operations Management, 9*(3), 213–221.

Finset, A., Steine, S., Haugli, L., Steen, E., & Laerum, E. (2002). The brief approach/avoidance coping questionnaire: Development and validation. *Psychology, health & medicine*, *7*(1), 75-85.

Fitzgerald G., & Siddiqui, F. A. (2002). Business process reengineering and flexibility: a case for unification. *International Journal of Flexible Manufacturing Systems*, *14*(1), 73–86.

Flynn, B. B., Schroeder, R. G., & Sakakibara, S. (1994). A framework for quality management research and an associated measurement instrument. *Journal of Operations Management, 11*, 339–366.

Forker, L. (1999). Factors affecting supplier quality performance. *Journal of Operations Management*, *15*, 243–69.

Fricker, R. D., & Schonlau, M. (2002). Advantages and disadvantages of Internet research surveys: Evidence from the literature. *Field methods*, *14*(4), 347-367.

Fry, L. W. (2003). Toward a theory of spiritual leadership. *The Leadership Quarterly, 14*(6), 693–727.

Gaudenzi, B., & Borghesi, A. (2006). Managing risks in the supply chain using the AHP method. *The International Journal of Logistics Management*.

Gedajlovic, E., & Carney, M. (2010). Markets, hierarchies, and families: Toward a transaction cost theory of the family firm. *Entrepreneurship Theory and Practice*, *34*(6), 1145–1172.

Gerwin, D. (1993). Manufacturing flexibility: A strategic perspective. *Management Science, 39*(4), 395–410.

Ghadimi, P., & Heavey, C. (2014). Sustainable supplier selection in medical device industry: Toward sustainable manufacturing. *Procedia CIRP*, *15,* 165–170.

Ghodsypour, S. H., & O'Brien, C. (1998). A decision support system for supplier selection using an integrated analytic hierarchy process and linear programming. *International Journal of Production Economics*, *56*, 199–212.

Goebel, P., Reuter, C., Pibernik, R., & Sichtmann, C. (2012). The influence of ethical culture on supplier selection in the context of sustainable sourcing. *International Journal of Production Economics*, *140*(1), 7–17.

Goffin, K., Lemke, F., & Szwejczewski, M. (2006). An exploratory study of 'close' supplier–manufacturer relationships. *Journal of Operations Management*, *24*(2), 189–209.

Gonzalez, M. E., Quesada, Q., & Carlo, A. (2004). Determining the importance of the supplier selection process in manufacturing: A case study. *International Journal of Physical Distribution and Logistics Management*, *34*(6), 492–504.

Gören, H. G. (2018). A decision framework for sustainable supplier selection and order allocation with lost sales. *Journal of Cleaner Production*, *183*, 1156-1169.

Gorener, A. (2012). Comparing AHP and ANP: An application of strategic decisions making in a manufacturing company. *International Journal of Business and Social Science*, *3*(11), 194–208.

Govindan, K., Shankar, M., & Kannan, D. (2018). Supplier selection based on corporate social responsibility practices. *International Journal of Production Economics, 200,* 353–379.

Grewal, R., & Dharwadkar, R. (2002). The role of the institutional environment in marketing channels. *Journal of marketing*, *66*(3), 82-97.

Grover, R., Grover, R., Rao, V. B., & Kejriwal, K. (2016). Supplier selection using sustainable criteria in sustainable supply chain management. World Academy of Science, Engineering and Technology. *International Journal of Social, Behavioural, Educational, Economic, Business and Industrial Engineering*, *10*(5), 1775–1779.

Grover, V., & Malhotra, M. K. (2003). Transaction cost framework in operations and supply chain management research: theory and measurement. *Journal of Operations management*, *21*(4), 457-473.

Guarnieri, P., & Trojan, F. (2019). Decision making on supplier selection based on social, ethical, and environmental criteria: A study in the textile industry. *Resources, Conservation and Recycling*, *141*, 347–361.

Guerrero, J., & Kirkpatrick, C. (2001). Evaluating contractor past performance in the United States. *Public Procurement Law Review*, *10*, 243–259.

Gunasekaran, A. (1999). Agile manufacturing: A framework for research and development. *International Journal of Production Economics*, *62*(1,2), 87–105.

Gupta, A., Singh, O., & Garg, R. (2015). Analytical network process (ANP): An approach for supplier selection in an automobile organization. *European Journal of Advances in Engineering and Technology*, *2*(9), 83–89.

Gupta, H., & Barua, M.K. (2017). Supplier selection among SMEs on the basis of their green innovation ability using BWM and fuzzy TOPSIS. *Journal of Cleaner Production*, *152*, 242–258.

Gurel, O., Acar, A. Z., Onden, I., & Gumus, I. (2015). Determinants of the green supplier selection. *Procedia-Social and Behavioral Sciences*, *181*, 131–139.

Gustin, C. M., Daugherty, P. J., & Ellinger, A.E. (1997). Supplier selection decisions in systems/software purchases. *Journal of Purchasing and Materials Management, 3*(4), 41–46.

Hair, J. F., Black Jr, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Pearson Prentice Hall, USA.

Hall, R. W. (1983). *With the American Production and Inventory Control Society. APIC*S, *Zero Inventories* (Zéro stock), Homewood, Il, Dow-Jones-Irwin.

Hamdan, S., & Cheaitou, A. (2017a). Dynamic green supplier selection and order allocation with quantity discounts and varying supplier availability. *Computers & Industrial Engineering*, *110*, 573–589.

Hamdan, S., & Cheaitou, A. (2017b). Supplier selection and order allocation with green criteria: An MCDM and multi-objective optimization approach. *Computers & Operations Research*, *81*, 282–304.

Handfield, R. (2006). *Supply market intelligence: A managerial handbook for building sourcing strategies*. CRC Press.

Handfield, R. B., & Bechtel, C. (2002). The role of trust and relationship structure in improving supply chain responsiveness. *Industrial Marketing Management*, *31*(4), 367–382.

Handfield, R. B., & Nichols Jr, E. L. (1999). *Introduction to supply chain management.* Prentice-Hall, NJ.

Hansen, T. (2001). Quality in the marketplace: A theoretical and empirical investigation. *European management journal*, *19*(2), 203-211.

Harland, C. M. (1996). Supply chain management: Relationships, chains and networks. *British Journal of Management*, *7*, S63-S80.

Harland, C. M., Lamming, R. C., & Cousins, P. D. (1999). Developing the concept of supply strategy. *International Journal of Operations & Production Management*, *19*(7), 650–673.

Hashemi, S. H., Karimi, A., & Tavana, M. (2015). An integrated green supplier selection approach with analytic network process and improved Grey relational analysis. *International Journal of Production Economics*, *159*, 178–191.

Heidarzade, A., Mahdavi, I., & Mahdavi-Amiri, N. (2016). Supplier selection using a clustering method based on a new distance for interval type-2 fuzzy sets: A case study. *Applied Soft Computing*, *38*, 213–231.

Hemmert, M., Kim, D., Kim, J. & Cho, B. (2016). Building the supplier's trust: Role of institutional forces and buyer firm practices. *International Journal of Production Economics*, *180*, 25–37.

Heracleous, L., & Lan, L. L. (2012). Agency theory, institutional sensitivity, and inductive reasoning: Towards a legal perspective. *Journal of Management Studies*, *49*(1), 223-239.

Heragu, S. S., Du, L., Mantel, R. J., & Schuur, P. C. (2005). Mathematical model for warehouse design and product allocation. *International Journal of Production Research*, *43*(2), 327–338.

Hirakubo, N., & Kublin, M. (1998). The relative importance of supplier selection criteria: The case of electronic components procurement in Japan. *Journal of Supply Chain Management*, *34*(2), 19–24.

Hofstede, G., Neuijen, B., Daval Ohavy, D., & Sanders, G. (1990). Measuring organizational cultures: A qualitative and quantitative study across twenty cases. *Administrative Science Quarterly, 35*, 286–316.

House, R. J. (2004). An overview of the GLOBE research program. *Transformative Organizations: A Global Perspective*, 483.

Hsu, C. W., & Hu, A. H. (2009). Applying hazardous substance management to supplier selection using analytic network process. *Journal of Cleaner Production*, *17*(2): 255–264.

Hwang, C. L., & Yoon, K. (1981). Methods for multiple attribute decision making. In *Multiple attribute decision making* (58–191). Springer: Berlin, Heidelberg.

Igarashi, M., de Boer, L., & Fet, A. M. (2013). What is required for greener supplier selection? A literature review and conceptual model development. *Journal of Purchasing and Supply Management*, 19(4), 247–263.

Igarashi, M., de Boer, L., & Michelsen, O. (2015). Investigating the anatomy of supplier selection in green public procurement. *Journal of Cleaner Production*, *108*, 442–450.

Jackson, A. Y., & Mazzei, L. A. (2013). Plugging one text into another: Thinking with theory in qualitative research. *Qualitative inquiry*, *19*(4), 261-271.

Jadidi, O. M., Zolfaghari, S., & Cavalieri, S. (2014). A new normalized goal programming model for multi-objective problems: A case of supplier selection and order allocation. *International Journal of Production Economics*, *148*, 158–165.

Jain, V., Kumar, S., Kumar, A., & Chandra, C. (2016). An integrated buyer initiated decision-making process for green supplier selection. *Journal of Manufacturing Systems*, *41*, 256–265.

Kadkhodazadeh, H., & Morovati Sharifabadi, A. (2012). Supplier selection with fuzzy conclusion system. *Production and Operations Management, 4*(7), 115–132.

Kahraman, C., Cebeci, U., & Ulukan, Z. (2003). Multi-criteria supplier selection using fuzzy AHP. *Logistics information management*.

Kajornboon, A. B. (2005). Using interviews as research instruments. *E-journal for Research Teachers*, *2*(1), 1-9.

Kambiz, S., Amin, S., Elnaz, S., & Mohammad, N. (2012). Application of analytical hierarchy process technique to evaluate and selecting suppliers in an effective supply chain. *Arabian Journal of Business and Management Review*, *1*(6), 119–132.

Kannan, V. R., & Tan, K. C. (2002). Supplier selection and assessment: their impact on business performance. *Journal of Supply Chain Management: A Global Review of Purchasing and Supply, 38*(4), 11–21.

Kannan, V. R., & Tan, K. C. (2003). Attitudes of US and European managers to supplier selection and assessment and implications for business performance. *Benchmarking: An International Journal*.

Kannan, V. R., & Tan, K. C. (2006). Buyer-supplier relationships: The impact of supplier selection and buyer-supplier engagement on relationship and firm performance. *International Journal of Physical Distribution & Logistics Management*, *36*(10), 755–775.

Kanwal, A., & Rajput, A. (2016). A transaction cost framework in supply chain relationships: a social capital perspective. *Journal of Relationship Marketing*, *15*(1–2), 92–107.

Kaplan, S., & Sawhney, M. (2000). E-hubs: the new B2B marketplaces. *Harvard business review*, *78*(3), 97–106.

Katsikeas, C. S., & Leonidou, L. C. (1996). International supplier selection: The relevance of import dependence. *Journal of Global Marketing*, *9*(3), 23–45.

Kelman, S. (1990). *Procurement and public management: The fear of discretion and the quality of government performance*. American Enterprise Institute, Washington, DC.

Kilincci, O., & Aslı Onal, S. (2011). Fuzzy AHP approach for supplier selection in a washing machine company. *Journal of Expert Systems with Applications*, *38*, 9656–9664.

Kim, J., & Mahoney, J. T. (2005). Property rights theory, transaction costs theory, and agency theory: An organizational economics approach to strategic management. *Managerial and decision economics*, *26*(4), 223–242.

Kleindorfer, P. R., Singhal, K., & van Wassenhove, L. N. (2005). Sustainable operations management. *Production and Operations Management*, *14*, 482–492.

Knight, J., Holdsworth, D., & Mather, D. (2007). Country-of-origin and choice of food imports: an in-depth study of European distribution channel gatekeepers. Journal of International Business Studies, 38, 107-25

Konys, A. (2019). Green Supplier Selection Criteria: From a Literature Review to a Comprehensive Knowledge Base. *Sustainability*, *11*(15), 4208.

Koontz, H., & Donnell, C. (1993). *Introduction to management*. New York: McGraw-Hill.

Koste, L. L., & Malhotra, M. K. (1999). A theoretical framework for analysing the dimensions of manufacturing flexibility. *Journal of Operations Management, 18*(1), 75–93.

Koste, L. L., Malhotra, M. K., & Sharma, S. (2004). Measuring dimensions of manufacturing flexibility. *Journal of Operations Management, 22*(2), 171–196.

Koulikoff-Souviron, M., & Harrison, A. (2008). Interdependent supply relationships as institutions: The role of HR practices. *International Journal of Operations & Production Management*.

Kouvelis, P., & Niederhoff, J. (2007). On the globalization of operations and supply chain strategies: a conceptual framework and its application. In Lee, H.L. & Lee, C.-Y. (eds), *Building supply chain excellence in emerging economies – international*

series in operations research and management science (pp. 1–36). Springer: New York.

Krause, D. R., Handfield, R. B., & Tyler, B. B. (2007). The relationships between supplier development, commitment, social capital accumulation and performance improvement. *Journal of Operations Management*, *25*(2), 528–545.

Kumar, D. T., Palaniappan, M., Kannan, D., & Shankar, K. M. (2014). Analyzing the CSR issues behind the supplier selection process using ISM approach. *Resources, Conservation and Recycling*, *92*, 268–278.

Kumar, S., Parashar, N., & Haleem, A. (2009). Analytical hierarchy process applied to vendor selection problem: small scale, medium scale and large-scale industries. *Business Intelligence Journal, 2*(2), 355–362.

La Londe, B. J., & Masters, J. M. (1994). Emerging logistics strategies: Blueprints for the next century. *International Journal of Physical Distribution & Logistics Management*, *24*(7), 35–47.

Lado, A. A., Boyd, N. G., & Wright, P. (1992). A competency-based model of sustainable competitive advantage: Toward a conceptual integration. *Journal of Management, 18*(1), 77–91.

Laínez, J. M., Kopanos, G. M., Badell, M., Espuña, A., & Puigjaner, L. (2008). Integrating strategic, tactical and operational supply chain decision levels in a model predictive control framework. In *Computer Aided Chemical Engineering* (Vol. 25, pp. 477-482). Elsevier.

Lee, E. K., Ha, S., & Kim, S. K. (2001). Supplier selection and management system considering relationships in supply chain management. *IEEE transactions on Engineering Management*, *48*(3), 307-318.

Lee, H. & Chuang, T. (2009). *The impact of leadership styles on job stress and turnover intention: Taiwan insurance industry as an example*. Taiwan: Tatung University.

Leenders, M. R., Fearon, H. E., Flynn, A., & Johnson, P. F. (2006). *Supply processes, purchasing and supply management* (13th ed., p. 79). McGraw-Hill College.

Lehmann, D. R., & O'Shaughnessy, J. (1974). Difference in attribute importance for different industrial products. *Journal of Marketing*, *38*, 36–42.

Lehmann, D. R., & O'Shaughnessy, J. (1982). Decision criteria used in buying different categories of products. *Journal of Purchasing Material Management*, *28*, 9–14.

Li, S., Rao, S. S., Ragu-Nathan, T. S., & Ragu-Nathan, B. (2005). Development and validation of a measurement instrument for studying supply chain management practices. *Journal of operations management*, *23*(6), 618-641.

Lienland, B., Baumgartner, A., & Knubben, E. (2013). The undervaluation of corporate reputation as a supplier selection factor: An analysis of ingredient branding of complex products in the manufacturing industry. *Journal of Purchasing and Supply Management*, *19*(2), 84–97.

Lima-Junior, F. R., & Carpinetti, L. C. R. (2016). A multicriteria approach based on fuzzy QFD for choosing criteria for supplier selection. *Computers & Industrial Engineering*, *101*, 269–285.

Lirn, T. C., Thanopoulou, H. A., Beynon, M. J., & Beresford, A. K. C. (2004). An application of AHP on transhipment port selection: a global perspective. *Maritime Economics & Logistics*, *6*(1), 70-91.

Liu, H., Ke, W., Wei, K. K., Gu, J., & Chen, H. (2010). The role of institutional pressures and organizational culture in the firm's intention to adopt internet-enabled supply chain management systems. *Journal of Operations Management*, *28*(5), 372–384.

Livanis, G., Robertson, C. J., Al-Shuaibi, K. M., & Hussain, K. (2016). Outsourcing destination choices: The role of economic and cultural attributes. *International Marketing Review*, *33*(1), 51–87.

Lu, M., & Geyao, Y. (2010). The selection of construction material suppliers in supplier relationship management (SRM). In *2010 International Conference of Information Science and Management Engineering* (Vol. 1, pp. 189-192). IEEE.

Luthra, S., Govindan, K., Kannan, D., Mangla, S. K., & Garg, C. P. (2017). An integrated framework for sustainable supplier selection and evaluation in supply chains. *Journal of Cleaner Production*, *140*, 1686–1698.

Lysons, K., & Farrington, B. (2012). *Purchasing and supply chain management* (8th ed.). Pearson Education Limited: Harlow.

Mani, V., Agrawal, R., & Sharma, V. (2014). Supplier selection using social sustainability: AHP based approach in India. *International Strategic Management Review*, *2*(2), 98–112.

Mansour, A., & Jakka, A. (2013). Is total quality management feasible in a developing context? The employees' perspective in the United Arab Emirates public sector. *International Journal of Public Administration*, *36*(2), 98–111.

Manuel, K. (2013). *Evaluating the 'past performance' of federal contractors: legal requirements and issues*. Congressional Research Service: Washington, DC.

Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business Logistics*, *22*(2), 1–25.

Miller, J. G., Graham, M. B., Freeland, J. R., Hottenstein, M., Maister, D. H., Meredith, J., & Schmenner, R. W. (1981). Agenda for the 80s. *Journal of Production Operations Management*, *12*(4), 547–571.

Mills, A. (2005). Client and contractor attitudes to prequalification. *Proceedings of the 49th Annual Meeting of the American Association of Cost Engineers* (pp. 8.1–8.9). New Orleans: LA.

Min, H. (1994). International supplier selection: A multi-attribute utility approach. *International Journal of Physical Distribution & Logistics Management*, *24*(5), 24–33.

Mirmousa, S., & Dehnavi, H. D. (2016). Development of criteria of selecting the supplier by using the fuzzy DEMATEL method. *Procedia-Social and Behavioral Sciences*, *230*, 281–289.

Moghaddam, K. (2015). Fuzzy multi-objective model for supplier selection and order allocation in reverse logistics systems under supply and demand uncertainty. *Expert Systems with Applications*, *42*, 6237–6254.

Molamohamadi, Z., Ismail, N., Leman, Z., & Zulkifli, N. (2013). Supplier selection in a sustainable supply chain. *Journal of Advanced Management Science*, *1*(3).

Monczka, R. H., & Giunipero, R. L., & Patterson J. (2011). *Purchasing and supply chain management* (5th ed.). USA: South-Western, Cengage Learning.

Monczka, R., Handfield, R., Giunipero, L., & Patterson, J. (2009). *Purchasing and supply chain management*, (4th ed.). South Western Cengage Learning: Mason, OH.

Moore, J., & Moyer, L. (2002). Questionnaire design effects on interview outcomes. *Survey Methodology*, 03.

Morano, P., Locurcio, M., & Tajani, F. (2016). Cultural heritage valorization: an application of AHP for the choice of the highest and best use. *Procedia-Social and Behavioral Sciences*, *223*, 952-959.

Morgan, D. L. (1998). Practical strategies for combining qualitative and quantitative methods: Applications to health research. *Qualitative Health Research*, *8*(3), 362–376.

Morgan, R. M., & Hunt, S. D. (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing, 58*, 20–38.

Morlok, E. K., & Chang, D. J. (2004). Measuring capacity flexibility of a transportation system. *Transportation Research Part A: Policy and Practice, 38*(6), 405–420.

Mukherjee, K. (2014). Supplier selection criteria and methods: past, present and future. *International Journal of Operational Research*, *27*(1–2), 356–373.

Muralidharan, C., Anantharaman, N., & Deshmukh, S. G. (2002). A multi-criteria group decision making model for supplier rating. *Journal of Supply Chain Management*, *38*(3), 22–33.

Mwikali R., & Kavale, K. (2012). Factors affecting the selection of optimal suppliers in procurement management. *International Journal of Humanities and Social Science, 2*(4), 189–193.

Nadoushani, Z. S. M., Akbarnezhad, A., Jornet, J. F., & Xiao, J. (2017). Multi-criteria selection of façade systems based on sustainability criteria. *Building and Environment*, *121*, 67–78.

Naim, M. M., Potter, A. T., Mason, R. J., & Bateman, N. (2006). The role of transport flexibility in logistics provision. *The International Journal of Logistics Management*, *17*, 297–311.

Narasimhan, R. (1983). An analytical approach to supplier selection. *Journal of Purchasing and Materials management*, *19*(4), 27–32.

Narasimhan, R., & Jayaram, J. (1998). Causal linkages in supply chain management: an exploratory study of North American manufacturing firms. *Decision sciences*, *29*(3), 579–605.

Naylor, J. B., Naim, M. M., & Berry, D. (1999). Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain. *International Journal of Production Economics, 62*(1,2), 107–118.

Noeiaghaei, N. (2009). *Corporate social responsibility in UAE: A case study of Jumeirah Group's CSR practices*. Doctoral dissertation, The British University in Dubai (BUiD).

Norman, W., & MacDonald, C. (2004). Getting to the bottom of 'triple bottom line'. *Business ethics quarterly*, *14*(2), 243–262.

Nydick, R. L., & Hill, R. P. (1992). Using the analytic hierarchy process to structure the supplier selection procedure. *International Journal of Purchasing and Materials Management*, *28*(2), 31–36.

Oboulhas C., Xiaofei X., Zhan D., & Sha, L. (2003). An integrated model for supplier selection process, *J. Harbin Institute of Technology 10*(1), 43–50.

Oishi, S. M. (2003). *How to conduct in-person interviews for surveys* (Vol. 5). London: Sage.

Olawale, Y. A., & Sun, M. (2010). Cost and time control of construction projects: Inhibiting factors and mitigating measures in practice. *Construction Management and Economics*, *28*(5), 509–526.

Orji, I. J., & Wei, S. (2015). An innovative integration of fuzzy-logic and systems dynamics in sustainable supplier selection: A case on manufacturing industry. *Computers & Industrial Engineering*, *88,* 1–12.

Özfirat, Pinar M. & Tasoglu, Gökcecicek T. & Memis, Conca T. 2014. A fuzzy analytic hierarchy process methodology for the supplier selection problem. Journal of Enterprise Information Management. Volume 27 (3), 292-301.

Pal, O., Gupta, A. K., & Garg, R. K. (2013). Supplier selection criteria and methods in supply chains: A review. *International Journal of Social, Management, Economics and Business Engineering*, 7(10), 1403–1409.

Pan, A. C. (1989). Allocation of order quantity among suppliers. *Journal of Purchasing and Material Management*, *25*(3), 36–39.

Parkouhi, S. V., & Ghadikolaei, A. S. (2017). A resilience approach for supplier selection: Using fuzzy analytic network process and grey VIKOR techniques. *Journal of Cleaner Production*, *161*, 431–451.

Patil, A. A., Kumthekar, M. B., & Landage, A. B. (2016). A review of supplier evaluation and selection approaches in supply chain of construction industry. *International Journal of Engineering Research*, *5*(1), 120–122.

Peck, H. (2005). Drivers of supply chain vulnerability: an integrated framework. *International journal of physical distribution & logistics management*.

Petersen, K. J., Handfield, R. B. & Ragatz, G. L. (2005). Supplier integration into new product development: coordinating product, process and supply chain design. *Journal of Operations Management, 23*(3–4), 371–388.

Pienaar, W. (2009). *Introduction to business logistics*. Southern Africa: Oxford University.

Piercy, N. F., Katsikeas, C. S., & Cravens, D. W. (1997). Examining the role of buyer-seller relationships in export performance. *Journal of World Business*, *32*(2), 73–86.

Piron, F. (2000). Consumers' perceptions of the country-of-origin effect on purchasing intentions of (in) conspicuous products. *Journal of Consumer Marketing*.

Polat, G., & Eray, E. (2015). An integrated approach using AHP-ER to supplier selection in railway projects. *Procedia Engineering*, *123*, 415–422.

Potoski, M. (2008). State and local government procurement and the winter commission. *Public Administration Review, 68*, 58–69.

Prater, E., Biehl, M., & Smith, M. A. (2001). International supply chain agility – tradeoffs between flexibility and uncertainty. *International Journal of Operations and Production Management*, *21*, 823–839.

Raajeev, B. B. (2017). *The road ahead: Growing momentum in corporate responsibility reporting in the UAE*. KPMG: Dubai.

Radivojević, G., & Gajović, V. (2014). Supply chain risk modeling by AHP and Fuzzy AHP methods. *Journal of Risk Research*, *17*(3), 337-352.

Rajesh, R., & Ravi, V. (2015). Supplier selection in resilient supply chains: A grey relational analysis approach. *Journal of Cleaner Production*, *86*, 343–359.

Rao, C., Xiao, X., Goh, M., Zheng, J., & Wen, J. (2017). Compound mechanism design of supplier selection based on multi-attribute auction and risk management of supply chain. *Computers & Industrial Engineering*, 105, 63–75.

Rattray, J., & Jones, M. C. (2007). Essential elements of questionnaire design and development. *Journal of clinical nursing*, *16*(2), 234-243.

Razzaq, A., Thaheem, M. J., Maqsoom, A., & Gabriel, H. F. (2018). Critical external risks in international joint ventures for construction industry in Pakistan. *International Journal of Civil Engineering*, *16*(2), 189–205.

Reuter, C., Goebel, P., & Foerstl, K. (2012). The impact of stakeholder orientation on sustainability and cost prevalence in supplier selection decisions. *Journal of Purchasing and Supply Management*, *18*(4), 270–281.

Rezaei, J., Nispeling, T., Sarkis, J., & Tavasszy, L. (2016). A supplier selection life cycle approach integrating traditional and environmental criteria using the best worst method. *Journal of Cleaner Production*, *135*, 577–588.

Rhodes, C. (2018). *Financial services: Contribution to the UK economy*. London: House of Commons Library, Briefing Paper, 6193.

Riedl, D. F., Kaufmann, L., Zimmermann, C. & Perols, J. L. (2013). Reducing uncertainty in supplier selection decisions: Antecedents and outcomes of procedural rationality. *Journal of Operations Management, 31*(1–2), 24–36.

Ritchie, J., Lewis, J., Elam, G., Ritchie, J., & Lewis, J. (2003). Chapter 4 in qualitative research practice: a guide for social science students and researchers. *Designing and selecting samples*, *6*.

Roberts, C. B. (2012). *ASEAN regionalism: Cooperation, values and institutionalisation*. Routledge.

Rogers, K. W., Purdy, L., Safayeni, F. & Duimering, P. R. (2007). A supplier development program: Rational process or institutional image construction? *Journal of Operations Management, 25*(2), 556–572.

Rogers, S. C. (2009). *The supply-based advantage. How to link suppliers to your organization's corporate strategy*? AMACOM: New York.

Rojniruttikul, N. (2017). A multi-criteria approach for supplier selection: Case of motorcycle parts manufacturer in Thailand. *Review of Integrative Business and Economics Research*, *6*(3), 188.

Rose G. (2001). *Visual Methodologies*. London: Sage.

Rose, M., Rose, G. M., & Shoham, A. (2009). The impact of consumer animosity on attitudes towards foreign goods: A study of Jewish and Arab Israelis. *Journal of Consumer Marketing*, *26*(5), 330–339.

Roshandel, J., Miri-NargesI, S., & Hatami-Shirkouhi, L. (2013). Evaluating and selecting the supplier in detergent production industry using hierarchical fuzzy TOPSIS, *Applied Mathematical Modelling*, *37*, 10170–10181.

Rowe, W. G. (2001). Creating wealth in organizations: The role of strategic leadership. *Academy of Management Executive*, *15*, 81–94.

Saaty, T. L. (1980). *The analytic hierarchy process: planning, priority setting, resource allocation*. McGraw-Hill: New York.

Saaty, T. L. (1990). *Decision making for leaders: The analytic hierarchy process for decisions in a complex world*. RWS Publications: New York.

Saaty, T. L. (1996). *Decision making with dependence and feedback: The analytic network process*. RWS Publications: New York.

Saaty, T. L. (2001). *Fundamentals of the analytic hierarchy process. In the analytic hierarchy process in natural resource and environmental decision making.* Springer: Dordrecht.

Safa, M., Shahi, A., Haas, C. T., & Hipel, K. W. (2014). Supplier selection process in an integrated construction materials management model. *Automation in Construction*, *48*, 64–73.

Salam, M. A., & Khan, S. A. (2018). Achieving supply chain excellence through supplier management. *Benchmarking: An International Journal*, *25*(9), 4084–4102.

Sarkar, S., Pratihar, D. K., & Sarkar, B. (2018). An integrated fuzzy multiple criteria supplier selection approach and its application in a welding company. *Journal of Manufacturing Systems*, *46*, 163–178.

Sarkis, J., & Dhavale, D. G. (2015). Supplier selection for sustainable operations: A triple-bottom-line approach using a Bayesian framework. *International Journal of Production Economics*, *166*, 177–191.

Sarkis, J., & Talluri, S. (2002). A model for strategic supplier selection. *Journal of Supply Chain Management*, *38*(1), 18–28.

Saunders, M., Lewis, P., & Thornhill, A. (2007). *Research methods for business students* (5th ed.). Pearson Education Limited: United Kingdom.

Schmidt, G., & Wilhelm, W. E. (2000). Strategic, tactical and operational decisions in multi-national logistics networks: a review and discussion of modelling issues. *International Journal of Production Research*, *38*(7), 1501-1523.

Seitanidi, M. M., & Crane, A. (2009). Implementing CSR through partnerships: Understanding the selection, design and institutionalisation of nonprofit-business partnerships. *Journal of Business Ethics*, *85*(2), 413–429.

Şen, S., Başligil, H., Şen, C. G., & Baracli, H. (2008). A framework for defining both qualitative and quantitative supplier selection criteria considering the buyer–supplier integration strategies. *International Journal of Production Research*, *46*(7), 1825–1845.

Seuring, S. (2011). Supply chain management for sustainable products–insights from research applying mixed methodologies. *Business Strategy and the environment*, *20*(7), 471-484.

Shadab, R. (2012). Effects of ethical sales behavior considered through transaction cost theory: To whom is the customer loyal? *Oman Chapter of Arabian Journal of Business and Management Review*, *34*(974), 1–8.

Shahanaghi, K., & Yazdian, S. A. (2009). Vendor selection using a new fuzzy group TOPSIS approach. *Journal of Uncertain Systems, 3*(3), 221–231.

Shahroudi, K., & Tonekaboni, S. M. S. (2012). Application of TOPSIS method to supplier selection in Iran auto supply chain. *Journal of Global Strategic Management*, *12*, 123–131.

Shapiro, S. P. (2005). Agency theory. *Annu. Rev. Sociol.*, *31*, 263–284.

Shen, C. Y., & Yu, K. T. (2013). Strategic vender selection criteria. *Procedia Computer Science*, *17*, 350–356.

Shin, H., Collier, D. A., & Wilson, D.D. (2000). Supply management orientation and supplier/buyer performance. *Journal of Operations Management*, *18*(3), 317–333.

Shugart, C. (2005). The selection of concessionaires in the urban water sector: Does the standard procurement paradigm fit? *Proceedings of the European Workshop on Auctions and Public Service Procurement* (pp. 1–24). Paris.

Simatupang, T. M., & Sridharan, R. (2002). The collaborative supply chain. *The international journal of logistics management*, *13*(1), 15-30.

Simchi-levi, D., Kaminsky, P., & Simchi-levi, E. (2000). *Designing and managing the supply chain.* McGraw-Hill: Boston, MA.

Sitkin, S., & Weingart, L. (1995). Determinants of risky decision-making behavior: A test of the mediating role of risk perceptions and propensity. *Academy of Management Journal*, *38*(6), 1573–1592.

Smytka, D., & Clemens, M. W. (1993). Total cost supplier selection model: A case study. *The Journal of Supply Chain Management*, *29*(1), 42–49.

Snider, K., & Walkner, M. (2009). Enhancing use of past performance as a source selection criterion. In Thai, K. (Ed.), *International Handbook of Public Procurement* (pp. 613–630). CRC Press: Boca Raton, FL

So, K. C. (2000). Price and time competition for service delivery. *Manufacturing & Service Operations Management*, *2*(4), 392-409.

Sodenkamp, M. A., Tavana, M., & Di Caprio, D. (2016). Modeling synergies in multi-criteria supplier selection and order allocation: An application to commodity trading. *European Journal of Operational Research*, *254*(3), 859–874.

Song, W., Xu, Z., & Liu, H. C. (2017). Developing sustainable supplier selection criteria for solar air-conditioner manufacturer: An integrated approach. *Renewable and Sustainable Energy Reviews*, *79*, 1461–1471.

Sonmez, M. (2006). A review and critique of supplier selection process and practices. *Occasional Papers Series*, Loughborough University, UK.

Spagnolo, G. (2012). Reputation, competition, and entry in procurement. *International Journal of Industrial Organization*, *30*(3), 291–296.

Stalk, G. J. (2006). Surviving the China riptide. *Supply Chain Management Review*, *10*(4), 18–26.

Stanley, L. L., & Wisner, J. D. (2001). Service quality along the supply chain: Implications for purchasing. *Journal of Operations Management*, *19*(3), 287–306.

Stogdill, R. M., & Coons, A. E. (1957). *Leader behaviour, its description and measurement.* Ohio: Bureau of Business Research, The Ohio State University, 88, 1–27.

Swafford, P. M., Ghosh, S., & Murthy, N. N. (2006). A framework for assessing value chain agility. *International Journal of Operations and Production Management, 26*(2), 118–140.

Tachizawa, E. M., & Thomsen, C. G. (2007). Drivers and sources of supply flexibility: An exploratory study. *International Journal of Operations & Production Management, 27*, 1115–1136.

Tam, M. C., & Tummala, V. M. R. (2001). An application of the AHP in vendor selection of a telecommunications system. *International Journal of Management Science*, *29*(2), 171–182.

Tan, K. C., Kannan, V. R., & Handfield, R. B. (1998). Supply chain management: supplier performance and firm performance. *Journal of Supply Chain Management*, *34*(3), 2.

Tate, W. L., Dooley, K. J. & Ellram, L. M. (2011). Transaction cost and institutional drivers of supplier adoption of environmental practices. *Journal of Business Logistics, 32*(1), 6–16.

Tavakol, M., & Sandars, J. (2014). Quantitative and qualitative methods in medical education research: AMEE Guide No 90: Part II. *Medical Teacher*, *36*(10), 838–848.

Tayur, S., Ganeshan, R., & Magazine, M. (Eds.). (2012). *Quantitative models for supply chain management* (Vol. 17). Springer Science & Business Media.

Teng, S., & Jaramillo, H. (2005). A model for evaluation and selection of suppliers in global textile and apparel supply chains. *International Journal of Physical Distribution & Logistics Management*, *35*(7/8), 503–523.

Thakur, V., & Anbanandam, R. (2015). Supplier selection using grey theory: A case study from Indian banking industry. *Journal of Enterprise Information Management, 28*(6), 769–787.

Thanki, S., Govindan, K., & Thakkar, J. (2016). An investigation on lean-green implementation practices in Indian SMEs using analytical hierarchy (AHP) approach. *Journal of Cleaner Production*, *135*, 284–298.

Thompson, K. N. (1990). Vendor profile analysis. *Journal of Purchasing and Materials Management*, *26*(1), 11–18.

Thorelli, H. B., & Glowacka, A. E. (1995). Willingness of American industrial buyers to source internationally. *Journal of Business Research*, *32*(2), 21–30.

Thornton, L. M., Autry, C. W., Gligor, D. M., & Brik, A. B. (2013). Does socially responsible supplier selection pay off for customer firms? A cross-cultural comparison. *Journal of Supply Chain Management*, *49*(3), 66–89.

Timmerman, E. (1986a). An approach to supplier performance evaluation. *Journal of Purchasing and Materials Management*, *22*, 2–8.

Timmerman, E. (1986b). An approach to vendor performance evaluation. *Journal of Supply Chain Management, 22*(4), 2–8.

Timmermans, K. (2008). *The secrets of successful low-cost-country sourcing*. Retrieved from www.accenture.com/Global/Research_and_Insights/Outlook/TheSourcing.htm [Accessed: 14–03–2018].

Tolbert, P. S., Zucker, L. G., Clegg, S. R., Hardy, C., & Nord, W. R. (1996). Handbook of organization studies. *The Institutionalization of Institutional Theory*, 175-190.

Tracey, M. & Chong, L. T. (2001). Empirical analysis of supplier selection and involvement, customer satisfaction and firm performance. *Supply Chain Management*, *6*(4), 174–188.

Tracey, M., & Leng Tan, C. (2001). Empirical analysis of supplier selection and involvement, customer satisfaction, and firm performance. *Supply Chain Management: An International Journal*, *6*(4), 174–188.

Trapp, A. C., & Sarkis, J. (2016). Identifying robust portfolios of suppliers: A sustainability selection and development perspective. *Journal of Cleaner Production, 112*, 2088–2100.

Tsai, W. H., Lee, P. L., Shen, Y. S., & Lin, H. L. (2012). A comprehensive study of the relationship between enterprise resource planning selection criteria and enterprise resource planning system success. *Information & Management*, *49*(1), 36–46.

Turner, I. (1988). An independent system for the evaluation of contract tenders. *Journal of Operation Research Society*, 39, 551–561.

Ulutas, A., Shukla, N., Kiridena, S., & Gibson, P. (2016). A utility-driven approach to supplier evaluation and selection: Empirical validation of an integrated solution framework. *International Journal of Production Research*, *54*(5), 1554–1567.

Upton, D. M. (1994). The management of manufacturing flexibility. *California Management Review, 36*(2), 72–89.

Upton, D.M. (1995). What really makes factories flexible? *Harvard Business Review*, 73(4), 74–84.

Van de Rijt, J., Hompes, M., & Santema, S. (2010). The Dutch construction industry: an overview and its use of performance information. *Journal for the Advancement of Performance Information & Value*, *2*(1), 33–56.

Van Der Rhee, B., Verma, R., & Plaschka, G. (2009). Understanding trade-offs in the supplier selection process: The role of flexibility, delivery and value-added services/support. *International Journal of Production Economics*, *120*, 30–41.

van Weele, A. J. (1994). *Purchasing management: Analysis, planning and practice*. Chapman & Hall.

Verma, R., & Pullman, M. E. (1998). An analysis of the supplier selection process. *International Journal of Management Science*, *26*(6), 739–750.

Vickery, S. K., Jayaram, J., Droge, C., & Calantone, R. (2003). The effects of an integrative supply chain strategy on customer service and financial performance: An analysis of direct versus indirect relationships. *Journal of Operations Management*, *21*(5), 523–539.

Vickery, S. N., Calantone, R., & Droge, C. (1999). Supply chain flexibility: An empirical study. *The Journal of Supply Chain Management, 35*(3), 16–24.

Vokurka, R. J., & O'Leary-Kelly, S. W. (2000). A review of empirical research on manufacturing flexibility. *Journal of Operations Management, 18*(4), 485–501.

Vonderembse, M.A., & Tracey, M. (1999). The impact of supplier selection criteria and supplier involvement on manufacturing performance. *Journal of Supply Chain Management, 35*(3), 33–39.

Voordijk, H., De Haan, J., & Joosten, G. J. (2000). Changing governance of supply chains in the building industry: A multiple case study. *European Journal of Purchasing & Supply Management*, *6*(3–4), 217–225.

Voss, C. (2010). Case research in operations management. In *Researching operations management* (pp. 176–209). Routledge.

Wang, M., & Zhong, W. (2009). The Manufacturing Enterprise Supplier Performance Evaluation Indicator Selection under E-procurement. In *2009 International Conference on Electronic Commerce and Business Intelligence* (pp. 7–11). IEEE.

Wang, M., Zhang, Q., Wang, Y., & Sheng, S. (2016). Governing local supplier opportunism in China: Moderating role of institutional forces. *Journal of Operations Management*, *46*, 84–94.

Wang, Z., Bapst, V., Heess, N., Mnih, V., Munos, R., Kavukcuoglu, K., & de Freitas, N. (2016). Sample efficient actor-critic with experience replay. *arXiv preprint arXiv:1611.01224*.

Waris, M., Liew, M. S., Khamidi, M. F., & Idrus, A. (2014). Criteria for the selection of sustainable onsite construction equipment. *International Journal of Sustainable Built Environment*, *3*(1), 96–110.

Watt, D., Kayis, B., & Willey, K. (2010). The relative importance of tender evaluation and contractor selection criteria. *International Journal of Project Management*, *28*(13), 51–60.

Weber, C. A., Current, J. R., & Benton, W.C. (1991). Supplier selection criteria and methods. *European Journal of Operational Research*, *50*(1), 2–18.

Wei, S. Y., Jinlong, Z., & Zhicheng, L. (1997). A supplier-selecting system using a neural network. *IEEE International Conference on Intelligent Processing Systems 1*: 468–471.

Wetzstein, A., Hartmann, E., Benton Jr, W. C., & Hohenstein, N. O. (2016). A systematic assessment of supplier selection literature – state-of-the-art and future scope. *International Journal of Production Economics*, *182*, 304–323.

Whitfield, G., & Landeros, R. (2006). Supplier diversity effectiveness: Does organizational culture really matter? *Journal of Supply Chain Management, 42*(4), 16–28.

Willner, T., Gati, I., & Guan, Y. (2015). Career decision-making profiles and career decision-making difficulties: A cross-cultural comparison among US, Israeli, and Chinese samples. *Journal of Vocational Behavior*, *88*, 143–153.

Wilson, E. J. (1994). The relative importance of supplier selection criteria: A review and update. *International Journal of Purchasing and Materials Management*, *30*(3), 35–41.

Winter, S., & Lasch, R. (2016). Environmental and social criteria in supplier evaluation – Lessons from the fashion and apparel industry. *Journal of Cleaner Production*, *139*, 175–190.

Winston, W. L. (2002). Introduction to Mathematical Programming: Applications and Algorithms, Duxbury, (2002).

Wong, H., Holt, G., & Cooper, P. (2000). Lowest price or value? Investigation of UK construction clients' tender selection process. *Construction Management & Economics*, *18*(7), 767–774.

Wong, J. K., & Li, H. (2008). Application of the analytic hierarchy process (AHP) in multi-criteria analysis of the selection of intelligent building systems. *Building and Environment*, *43*(1), 108-125.

Wood, D. A. (2016). Supplier selection for development of petroleum industry facilities, applying multi-criteria decision-making techniques including fuzzy and intuitionistic fuzzy TOPSIS with flexible entropy weighting. *Journal of Natural Gas Science and Engineering*, *28*, 594–612.

Wu, Y., Chen, K., Zeng, B., Xu, H., & Yang, Y. (2016). Supplier selection in nuclear power industry with extended VIKOR method under linguistic information. *Applied Soft Computing*, *48*, 444–457.

Wu, Z., & Jia, F. (2018). Toward a theory of supply chain fields–understanding the institutional process of supply chain localization. *Journal of Operations Management*, *58*, 27-41.

Xia, W., & Wu, Z. (2007). Supplier selection with multiple criteria in volume discount environments. *Omega, 35*(5), 494–504.

Xie, E, Liang, J., & Zhou, K. (2016). How to enhance supplier performance in China: An integrative view of partner selection and partner control. *Industrial Marketing Management*, *56*, 156–166.

Xu, L., Kumar, D. T., Shankar, K. M., Kannan, D., & Chen, G. (2013). Analyzing criteria and sub-criteria for the corporate social responsibility-based supplier selection process using AHP. *The International Journal of Advanced Manufacturing Technology*, *68*(1–4), 907–916.

Yahya, S., & Kingsman, B. (1999). Vendor rating for an entrepreneur development programme: A case study using the analytic hierarchy process method. *Journal of the Operational Research Society*, *50*(9), 916–930.

Yan, T., Yang, Y., Dooley, K., & Chae, S. (2020). Trading-off innovation novelty and information protection in supplier selection for a new product development project: Supplier ties as signals. *Journal of Operations Management*.

Yen, C. H., & Pearn, W. L. (2009). Select better suppliers based on manufacturing precision for processes with multivariate data. *International Journal of Production Research*, *47*(11), 2961–2974.

Yeung, A. H. W., & Lo, V. H. Y. (2002). Impacts of supply quality management practices onQuality Performance: A Study in Hong Kong. *Proceedings of the 4th Asian ControlConference (ASCC 2002), Singapore*, 25-27.

Yildiz, A., & Yayla, A. (2015). Multi-criteria decision-making methods for supplier selection: A literature review. *South African Journal of Industrial Engineering*, *26*(2), 158–177.

Yilmaz, K. (2013). Comparison of quantitative and qualitative research traditions: Epistemological, theoretical, and methodological differences. *European Journal of Education*, 48(2), 311–325.

Yilmaz O, Gülsün B, Güneri A F, Özgürler Ş. (2011). Supplier selection of a textile company with ANP. *Int. Research Conf. Trends in Development of Machinery and Associated Technology, 15*, 257–60.

Yin, R. K. (2002). *Case study research: Design and methods*. Thousand Oaks, CA: SAGE Publications.

Yong, C. Y., & Mustaffa, E. N. (2012). Analysis of factors critical to construction project success in Malaysia. *Engineering, Construction and Architectural Management*, *19*(5), 543–556.

You, X. Y., You, J. X., Liu, H. C., & Zhen, L. (2015). Group multi-criteria supplier selection using an extended VIKOR method with interval 2-tuple linguistic information. *Expert Systems with Applications*, *42*(4), 1906–1916.

Youssef, M. A., Zairi, M., & Mohanty, B. (1996). Supplier selection in an advanced manufacturing technology environment: an optimization model. *Benchmarking for Quality Management & Technology*.

Yusuf, Y. Y., Sarhadi, M., & Gunasekaran, A. (1999). Agile manufacturing: The drivers, concepts and attributes. *International Journal of Production Economics, 62*(1/2), 33–43.

Zavadskas, E. K., Vilutiene, T., Turskis, Z., & Tamosaitiene, J. (2010). Contractor selection for construction works by applying SAW-G and TOPSIS grey techniques. *Journal of Business Economics and Management*, *11*(1), 34–55.

Zhang, J., & Chen, J. (2013). Supplier selection and procurement decisions with uncertain demand, fixed selection costs and quantity discounts. *Computers & Operations Research*, *40*(11), 2703–2710.

Zhang, Q., Vonderembse, M. A., & Lim, J.-S. (2003). Manufacturing flexibility: Defining and analyzing relationships among competence, capability, and customer satisfaction. *Journal of Operations Management, 21*(2), 173–191.

Zhang, Q., Vonderembse, M. A., & Lim, J. S. (2006). Spanning flexibility: supply chain information dissemination drives strategy development and customer satisfaction. *Supply Chain Management: An International Journal*.

Zikmund, W. G. (2003). *Business research methods (7th ed.)*. Thomson South Western: USA.

Zimmer, K., Froehling, M., & Schultmann, F. (2016). Sustainable supplier management: A review of models supporting sustainable supplier selection, monitoring and development. *International Journal of Production Research. 54*(5), 1412–1442.

Zomorrodi, M., & Fayezi, S. (2011). Understanding the concept of elasticity in supply chain relationships: An agency theory perspective. *CiteSeer.*

Zou, P. X., Sunindijo, R. Y., & Dainty, A. R. (2014). A mixed methods research design for bridging the gap between research and practice in construction safety. *Safety science*, *70*, 316-326.

Zouggari, A., & Benyoucef, L. (2012). Simulation based fuzzy TOPSIS approach for group multi-criteria supplier selection problem. *Engineering Applications of Artificial Intelligence*, *25*(3), 507–519.

Zsidisin, G. A., & Ellram, L. M. (2003). An agency theory investigation of supply risk m anagement. *Journal of supply chain management*, *39*(2), 15-27.

APPENDICES

Appendix A The research questionnaire questions

Part one: General information

Please indicate your gender	
Male ◯	Female ◯

Please indicate your age			
Less than 30 years ◯	30–40 years ◯	40–50 years ◯	More than 50 years ◯

Please indicate the highest level of education you have completed				
High school graduate ◯	Diploma/HD ◯	Bachelors ◯	Master ◯	Ph.D. ◯

Please indicate your current nationality			
◯	UAE National	◯	UK National

Please indicate your current job title			
◯	President/CEO	◯	Operations Manager
◯	Supply Chain Manager	◯	Purchasing Manager
◯	Supplier Relationship Manager	◯	Logistics Manager
Other (please specify): _____			

For how long you have been in this position?			
Less than 3 years ◯	3–6 years ◯	7–10 years ◯	More than 10 years ◯

How many employees do you have in your company?			
250-–500 ◯	501–1,000 ◯	1,001–1,500 ◯	More than 1,500 ◯

Please indicate the age of your company			
Less than 3 years ◯	3–6 years ◯	7–10 years ◯	More than 10 years◯

Please indicate the company country	
United Kingdom ◯	United Arab Emirates ◯

Part Two: Supplier selection criteria

This part is further divided into two sections, A and B. In section A, you are kindly asked to compare the main criteria for supplier selection, indicate which criterion is more important and then indicate the relative importance of the selected criterion on a scale from 1–9 (please see the table provided below). In section B, you are kindly asked to compare the sub-criteria, indicate which criterion is more important and then indicate the relative importance of the selected criterion on a scale from 1–9.

The Pairwise Comparison Scale		
Importance Intensity Number	Importance Intensity Name	Description
1	Equal Importance	The two criteria contribute equally to the decision
3	Moderate Importance	Slightly favour one criterion over the other
5	Strong Importance	Strongly favour one criterion over the other
7	Very Strong Importance	Very strongly favour one criterion over the other
9	Extreme Importance	Extremely favour one criterion over the other
You can also assign scale (2, 4, 6, and 8) to express intermediate values.		

Part A Main criteria pairwise comparison:

Criteria		Which is more important? A or B?	Intensity 1 to 9
A	B		
Supplier Experience	Supplier Financial Position		
Supplier Experience	Supplier Communication and Responsiveness		
Supplier Experience	Supplier Quality Management		
Supplier Experience	Supplier Process Performance		

Supplier Experience	Supplier Cultural Factors		
Supplier Experience	Supplier Green Practice		
Supplier Experience	Corporate Social Responsibility (CSR)		
Supplier Experience	Supplier Logistics Performance		
Supplier Financial Position	Supplier Communication and Responsiveness		
Supplier Financial Position	Supplier Quality Management		
Supplier Financial Position	Supplier Process Performance		
Supplier Financial Position	Supplier Cultural Factors		
Supplier Financial Position	Supplier Green Practice		
Supplier Financial Position	Corporate Social Responsibility (CSR)		
Supplier Financial Position	Supplier Logistics Performance		
Supplier Communication and Responsiveness	Supplier Quality Management		
Supplier Communication and Responsiveness	Supplier Process Performance		
Supplier Communication and Responsiveness	Supplier Cultural Factors		
Supplier Communication and Responsiveness	Supplier Green Practice		
Supplier Communication and Responsiveness	Corporate Social Responsibility (CSR)		
Supplier Communication and Responsiveness	Supplier Logistics Performance		
Supplier Quality Management	Supplier Process Performance		
Supplier Quality Management	Supplier Cultural Factors		
Supplier Quality Management	Supplier Green Practice		
Supplier Quality Management	Corporate Social Responsibility (CSR)		
Supplier Quality Management	Supplier Logistics Performance		
Supplier Process Performance	Supplier Cultural Factors		
Supplier Process Performance	Supplier Green Practice		
Supplier Process Performance	Corporate Social Responsibility (CSR)		
Supplier Process Performance	Supplier Logistics Performance		
Supplier Cultural Factors	Supplier Green Practice		
Supplier Cultural Factors	Corporate Social Responsibility (CSR)		
Supplier Cultural Factors	Supplier Logistics Performance		
Supplier Green Practice	Corporate Social Responsibility (CSR)		
Supplier Green Practice	Supplier Logistics Performance		
Corporate Social Responsibility (CSR)	Supplier Logistics Performance		

Part B Sub-criteria pairwise comparison:

1. Supplier Experience			
Criteria		Which is more important? A or B	Intensity 1 to 9
A	B		
Performance History and Delivery	Reputation		
Performance History and Delivery	Innovation and Creativity		
Performance History and Delivery	Amount of Past Business		
Performance History and Delivery	Marketing Position		
Performance History and Delivery	Supplier Expertise		
Reputation	Innovation and Creativity		
Reputation	Amount of Past Business		
Reputation	Marketing Position		
Reputation	Supplier Expertise		
Innovation and Creativity	Amount of Past Business		
Innovation and Creativity	Marketing Position		
Innovation and Creativity	Supplier Expertise		
Amount of Past Business	Marketing Position		
Amount of Past Business	Supplier Expertise		
Marketing Position	Supplier Expertise		

2. Supplier Financial Position			
Criteria		Which is more important? A or B	Intensity 1 to 9
A	B		
Financial Stability	Cost or Price		
Financial Stability	Desire for Business		
Financial Stability	Quantity Discount		
Financial Stability	Warranty and aftersales services		
Cost or Price	Desire for Business		
Cost or Price	Quantity Discount		
Cost or Price	Warranty and aftersales services		
Desire for Business	Quantity Discount		
Desire for Business	Warranty and aftersales services		
Quantity Discount	Warranty and aftersales services		

3. Supplier Communication and Responsiveness			
Criteria		Which is more important? A or B	Intensity 1 to 9
A	B		
Ability to Fill Emergency Orders	Response to Change		
Ability to Fill Emergency Orders	Process Flexibility		
Ability to Fill Emergency Orders	Customer Service		
Response to Change	Process Flexibility		
Response to Change	Customer Service		
Process Flexibility	Customer Service		

4. Supplier Quality Management			
Criteria		Which is more important? A or B	Intensity 1 to 9
A	B		
Quality System	Quality of Support Service		
Quality System	Meeting Regulatory Requirements		
Quality System	Production Facilities and Capabilities		
Quality System	Reliability		
Quality System	Organisational Leadership		
Quality of Support Service	Meeting Regulatory Requirements		
Quality of Support Service	Production Facilities and Capabilities		
Quality of Support Service	Reliability		
Quality of Support Service	Organisational Leadership		
Meeting Regulatory Requirements	Production Facilities and Capabilities		
Meeting Regulatory Requirements	Reliability		
Meeting Regulatory Requirements	Organisational Leadership		
Production Facilities and Capabilities	Reliability		
Production Facilities and Capabilities	Organisational Leadership		
Reliability	Organisational Leadership		

5. Supplier Process Performance			
Criteria		Which is more important? A or B	Intensity 1 to 9
A	B		
Bidding Procedure	Technological System and Technical Support		
Bidding Procedure	Future Manufacturing Capability		
Bidding Procedure	Process Capability		
Bidding Procedure	Design/Process Improvement		
Technological System and Technical Support	Future Manufacturing Capability		
Technological System and Technical Support	Process Capability		
Technological System and Technical Support	Design/Process Improvement		
Future Manufacturing Capability	Process Capability		
Future Manufacturing Capability	Design/Process Improvement		
Process Capability	Design/Process Improvement		

6. Supplier Cultural Factors			
Criteria		Which is more important? A or B	Intensity 1 to 9
A	B		
Patriotism to Same Culture and Beliefs	Location, Local or Foreign		
Patriotism to Same Culture and Beliefs	Admire History and Heritage		
Location, Local or Foreign	Admire History and Heritage		

7. Supplier Green Practice			
Criteria		Which is more important? A or B	Intensity 1 to 9
A	B		
Waste Disposal Schemes	Green Procurement		
Waste Disposal Schemes	Green Technology/Operations		
Waste Disposal Schemes	Green Certifications		
Green Procurement	Green Technology/Operations		
Green Procurement	Green Certifications		
Green Technology/Operations	Green Certifications		

8. Corporate Social Responsibility (CSR)			
Criteria		Which is more important? A or B	Intensity 1 to 9
A	B		
Ethical Behaviour	Philanthropic Responsibility		
Ethical Behaviour	Social Sustainability		
Ethical Behaviour	Environmental Sustainability		
Ethical Behaviour	Economic Sustainability		
Philanthropic Responsibility	Social Sustainability		
Philanthropic Responsibility	Environmental Sustainability		
Philanthropic Responsibility	Economic Sustainability		
Social Sustainability	Environmental Sustainability		
Social Sustainability	Economic Sustainability		
Environmental Sustainability	Economic Sustainability		

9. Supplier Logistics Performance			
Criteria		Which is more important? A or B	Intensity 1 to 9
A	B		
Location	Geographical Distance		
Location	Packaging		
Location	Post-production Configuration / Ease of Assembly		
Location	Hazardous Goods Management		
Geographical Distance	Packaging		
Geographical Distance	Post-production Configuration / Ease of Assembly		
Geographical Distance	Hazardous Goods Management		
Packaging	Post-production Configuration / Ease of Assembly		
Packaging	Hazardous Goods Management		
Post-production Configuration / Ease of Assembly	Hazardous Goods Management		

Appendix B AHP outputs

- Table A AHP output Weights of the main criteria (UK sample with CR less than 10%)

Person number	Supplier experience	Supplier financial position	Communication & responsiveness	Quality management	Process performance	Supplier cultural factors	Supplier green practices	CSR	Supplier logistics performance	CR
1	0.04	0.09	0.07	0.25	0.02	0.06	0.14	0.09	0.23	0.10
2	0.08	0.05	0.04	0.14	0.04	0.07	0.16	0.16	0.26	0.10
3	0.13	0.08	0.03	0.20	0.14	0.06	0.14	0.15	0.07	0.10
4	0.09	0.18	0.07	0.09	0.07	0.11	0.07	0.18	0.15	0.10
5	0.15	0.21	0.07	0.06	0.06	0.09	0.09	0.16	0.11	0.10
6	0.12	0.16	0.09	0.13	0.10	0.10	0.07	0.14	0.09	0.10
7	0.15	0.12	0.15	0.13	0.09	0.07	0.07	0.11	0.09	0.10
8	0.09	0.18	0.14	0.13	0.08	0.12	0.11	0.06	0.08	0.10
9	0.18	0.12	0.03	0.16	0.11	0.05	0.12	0.17	0.05	0.10
10	0.11	0.24	0.09	0.11	0.10	0.10	0.11	0.06	0.09	0.09
11	0.12	0.19	0.07	0.11	0.05	0.09	0.06	0.16	0.13	0.10
12	0.12	0.15	0.10	0.14	0.07	0.11	0.07	0.13	0.10	0.10
13	0.07	0.19	0.16	0.11	0.10	0.11	0.10	0.07	0.09	0.10
14	0.12	0.15	0.13	0.10	0.15	0.07	0.10	0.07	0.11	0.10
15	0.19	0.09	0.07	0.20	0.11	0.04	0.18	0.08	0.04	0.10
16	0.13	0.14	0.13	0.11	0.10	0.04	0.11	0.10	0.13	0.10
17	0.08	0.16	0.14	0.14	0.03	0.04	0.16	0.06	0.19	0.08
18	0.14	0.10	0.05	0.19	0.13	0.04	0.17	0.15	0.03	0.10
19	0.12	0.31	0.08	0.05	0.06	0.09	0.07	0.13	0.09	0.10
20	0.13	0.19	0.07	0.08	0.06	0.10	0.10	0.15	0.11	0.10
21	0.12	0.11	0.10	0.13	0.09	0.12	0.08	0.13	0.12	0.09
22	0.12	0.16	0.11	0.15	0.13	0.10	0.09	0.10	0.05	0.10
23	0.12	0.21	0.12	0.03	0.15	0.10	0.11	0.05	0.11	0.10
24	0.16	0.09	0.02	0.23	0.07	0.04	0.16	0.16	0.08	0.10
25	0.13	0.23	0.16	0.05	0.07	0.10	0.10	0.05	0.12	0.10

26	0.14	0.22	0.14	0.06	0.04	0.10	0.06	0.11	0.13	0.10
27	0.13	0.26	0.06	0.10	0.06	0.08	0.08	0.12	0.11	0.09
28	0.19	0.21	0.04	0.14	0.07	0.05	0.10	0.13	0.07	0.10
29	0.13	0.07	0.03	0.30	0.09	0.05	0.17	0.09	0.06	0.10
30	0.08	0.19	0.06	0.08	0.09	0.08	0.14	0.15	0.13	0.10
31	0.12	0.21	0.05	0.08	0.05	0.12	0.10	0.17	0.11	0.10
32	0.10	0.16	0.05	0.10	0.15	0.07	0.11	0.16	0.09	0.10
33	0.11	0.24	0.09	0.11	0.10	0.10	0.11	0.06	0.09	0.09
34	0.08	0.18	0.10	0.12	0.12	0.14	0.13	0.03	0.10	0.10
35	0.17	0.25	0.04	0.12	0.11	0.06	0.05	0.08	0.11	0.10
36	0.16	0.11	0.05	0.18	0.09	0.04	0.15	0.14	0.07	0.10
37	0.13	0.19	0.05	0.16	0.14	0.05	0.14	0.09	0.06	0.10
38	0.11	0.18	0.14	0.08	0.05	0.11	0.08	0.16	0.09	0.10
39	0.15	0.21	0.09	0.06	0.08	0.07	0.09	0.16	0.09	0.10
40	0.09	0.23	0.07	0.13	0.06	0.07	0.08	0.15	0.12	0.10
41	0.18	0.23	0.04	0.14	0.11	0.05	0.13	0.06	0.08	0.10
42	0.10	0.19	0.15	0.16	0.06	0.05	0.09	0.12	0.08	0.10
43	0.08	0.19	0.09	0.16	0.03	0.04	0.16	0.15	0.10	0.08
44	0.12	0.19	0.06	0.16	0.08	0.10	0.08	0.17	0.05	0.10
45	0.18	0.15	0.05	0.16	0.12	0.04	0.13	0.10	0.06	0.10
46	0.19	0.20	0.11	0.09	0.07	0.11	0.07	0.10	0.05	0.10
47	0.09	0.15	0.13	0.14	0.13	0.05	0.11	0.14	0.07	0.10
48	0.06	0.23	0.16	0.15	0.14	0.07	0.08	0.03	0.08	0.10
49	0.15	0.16	0.08	0.15	0.10	0.03	0.13	0.09	0.10	0.10
50	0.08	0.17	0.09	0.14	0.05	0.03	0.12	0.16	0.16	0.10
Weights	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8	W_9	
Average	0.12	0.17	0.09	0.13	0.09	0.08	0.11	0.12	0.10	

AHP output: Weights of the sub-criteria (UK sample with CR of '10% or less')

Table A1 Supplier experience:

Person number	Performance history & delivery	Reputation	Innovation & creativity	Amount of past business	Marketing position	Supplier expertise	CR
1	0.07	0.06	0.18	0.04	0.42	0.23	0.09
2	0.10	0.32	0.06	0.05	0.31	0.16	0.09
3	0.21	0.07	0.20	0.05	0.12	0.35	0.10
4	0.08	0.15	0.08	0.20	0.20	0.29	0.10
5	0.05	0.20	0.09	0.14	0.15	0.37	0.10
6	0.07	0.11	0.26	0.05	0.23	0.27	0.09
7	0.11	0.03	0.13	0.11	0.27	0.35	0.09
8	0.11	0.04	0.13	0.11	0.22	0.38	0.09
9	0.06	0.20	0.06	0.17	0.09	0.42	0.08
10	0.06	0.17	0.07	0.17	0.16	0.37	0.10
11	0.15	0.09	0.10	0.06	0.19	0.41	0.09
12	0.10	0.10	0.25	0.07	0.41	0.06	0.10
13	0.21	0.05	0.05	0.09	0.15	0.45	0.07
14	0.28	0.06	0.11	0.05	0.10	0.40	0.07
15	0.15	0.04	0.14	0.07	0.28	0.33	0.09
16	0.09	0.34	0.06	0.12	0.29	0.10	0.10
17	0.29	0.15	0.13	0.10	0.10	0.24	0.10
18	0.04	0.26	0.07	0.25	0.16	0.22	0.10
19	0.04	0.24	0.08	0.16	0.08	0.39	0.10
20	0.09	0.21	0.11	0.07	0.15	0.37	0.09
21	0.10	0.15	0.12	0.11	0.30	0.22	0.09
22	0.06	0.12	0.30	0.16	0.20	0.16	0.10
23	0.32	0.09	0.17	0.08	0.17	0.18	0.10
24	0.13	0.25	0.04	0.21	0.20	0.17	0.10
25	0.07	0.25	0.09	0.30	0.15	0.14	0.09
26	0.07	0.12	0.13	0.04	0.17	0.46	0.10
27	0.41	0.08	0.14	0.05	0.09	0.23	0.10
28	0.29	0.12	0.20	0.08	0.14	0.17	0.09
29	0.09	0.24	0.10	0.20	0.16	0.21	0.08
30	0.29	0.12	0.20	0.08	0.14	0.17	0.09
31	0.08	0.25	0.12	0.23	0.19	0.13	0.10
32	0.10	0.15	0.11	0.04	0.15	0.46	0.10
33	0.16	0.17	0.23	0.12	0.14	0.18	0.09
34	0.20	0.13	0.17	0.13	0.27	0.10	0.08
35	0.22	0.15	0.08	0.08	0.15	0.31	0.10
36	0.35	0.09	0.16	0.13	0.10	0.18	0.10
37	0.40	0.09	0.12	0.05	0.08	0.25	0.10
38	0.08	0.31	0.12	0.21	0.10	0.18	0.10

39	0.03	0.24	0.12	0.23	0.21	0.17	0.10
40	0.08	0.12	0.11	0.07	0.16	0.45	0.09
41	0.32	0.18	0.20	0.03	0.09	0.17	0.09
42	0.18	0.15	0.23	0.14	0.19	0.12	0.09
43	0.13	0.48	0.06	0.05	0.16	0.12	0.10
44	0.20	0.14	0.12	0.09	0.15	0.32	0.10
45	0.30	0.14	0.19	0.04	0.14	0.19	0.09
46	0.14	0.18	0.13	0.05	0.10	0.40	0.10
47	0.21	0.14	0.17	0.12	0.17	0.18	0.10
48	0.42	0.09	0.10	0.10	0.05	0.23	0.08
49	0.28	0.14	0.20	0.04	0.13	0.20	0.09
50	0.23	0.11	0.13	0.03	0.21	0.30	0.10
Weights	W_{11}	W_{12}	W_{13}	W_{14}	W_{15}	W_{16}	
Average	0.17	0.16	0.13	0.11	0.17	0.26	

Table A2 Financial position:

Person number	Financial stability	Cost and price	Desire for business	Quantity discount	Warranty & aftersales services	CR
1	0.22	0.15	0.10	0.05	0.47	0.10
2	0.37	0.19	0.05	0.12	0.27	0.10
3	0.46	0.22	0.12	0.07	0.13	0.07
4	0.24	0.12	0.12	0.05	0.48	0.08
5	0.22	0.15	0.06	0.05	0.52	0.08
6	0.40	0.14	0.08	0.08	0.30	0.07
7	0.22	0.24	0.26	0.12	0.16	0.09
8	0.26	0.31	0.12	0.04	0.27	0.07
9	0.33	0.22	0.17	0.10	0.18	0.10
10	0.15	0.15	0.12	0.06	0.52	0.08
11	0.22	0.19	0.17	0.13	0.29	0.09
12	0.34	0.12	0.11	0.07	0.37	0.09
13	0.25	0.21	0.12	0.07	0.35	0.10
14	0.47	0.14	0.08	0.08	0.23	0.09
15	0.32	0.32	0.11	0.07	0.17	0.10
16	0.37	0.11	0.07	0.05	0.39	0.09
17	0.36	0.20	0.11	0.13	0.20	0.09
18	0.33	0.24	0.17	0.05	0.22	0.10
19	0.32	0.16	0.15	0.06	0.32	0.08
20	0.18	0.12	0.11	0.04	0.55	0.09
21	0.48	0.20	0.08	0.04	0.20	0.09
22	0.25	0.27	0.11	0.14	0.23	0.11
23	0.38	0.32	0.07	0.07	0.16	0.11

24	0.26	0.33	0.13	0.12	0.16	0.09
25	0.26	0.19	0.08	0.05	0.42	0.10
26	0.35	0.11	0.12	0.07	0.34	0.10
27	0.39	0.24	0.13	0.06	0.18	0.10
28	0.40	0.26	0.11	0.08	0.15	0.06
29	0.36	0.19	0.13	0.14	0.19	0.11
30	0.17	0.15	0.13	0.11	0.44	0.10
31	0.31	0.14	0.18	0.05	0.32	0.08
32	0.43	0.13	0.08	0.09	0.27	0.08
33	0.20	0.28	0.23	0.08	0.21	0.11
34	0.27	0.27	0.17	0.04	0.25	0.09
35	0.39	0.09	0.12	0.09	0.31	0.06
36	0.34	0.25	0.14	0.06	0.21	0.08
37	0.41	0.17	0.19	0.08	0.15	0.10
38	0.25	0.30	0.14	0.05	0.26	0.09
39	0.28	0.20	0.12	0.09	0.31	0.07
40	0.37	0.23	0.11	0.04	0.25	0.09
41	0.44	0.18	0.11	0.05	0.22	0.04
42	0.29	0.19	0.09	0.12	0.31	0.09
43	0.44	0.16	0.06	0.07	0.27	0.06
44	0.36	0.24	0.10	0.05	0.26	0.09
45	0.35	0.29	0.13	0.09	0.14	0.09
46	0.37	0.14	0.08	0.07	0.35	0.08
47	0.18	0.36	0.12	0.13	0.21	0.06
48	0.24	0.38	0.12	0.18	0.08	0.07
49	0.31	0.40	0.11	0.04	0.13	0.08
50	0.24	0.20	0.08	0.08	0.40	0.10
Weights	W_{21}	W_{22}	W_{23}	W_{24}	W_{25}	
Average	0.32	0.21	0.12	0.08	0.28	

Table A3 Communication and responsiveness:

Person number	Ability to fill emergency orders	Response to change	Process flexibility	Customer service	CR
1	0.44	0.14	0.12	0.31	0.03
2	0.06	0.45	0.21	0.28	0.07
3	0.23	0.15	0.11	0.51	0.10
4	0.33	0.13	0.31	0.22	0.10
5	0.33	0.12	0.17	0.38	0.06
6	0.33	0.14	0.33	0.20	0.02
7	0.25	0.32	0.35	0.09	0.06
8	0.32	0.13	0.19	0.36	0.01
9	0.38	0.07	0.17	0.38	0.01

10	0.28	0.18	0.20	0.34	0.09
11	0.39	0.25	0.09	0.27	0.07
12	0.26	0.14	0.42	0.18	0.04
13	0.48	0.09	0.20	0.23	0.05
14	0.35	0.13	0.37	0.14	0.06
15	0.47	0.07	0.15	0.32	0.02
16	0.27	0.12	0.19	0.42	0.08
17	0.18	0.20	0.38	0.24	0.03
18	0.34	0.21	0.21	0.24	0.09
19	0.23	0.40	0.10	0.27	0.06
20	0.45	0.11	0.14	0.30	0.06
21	0.29	0.14	0.34	0.24	0.06
22	0.19	0.53	0.11	0.16	0.09
23	0.42	0.15	0.20	0.24	0.05
24	0.35	0.33	0.10	0.21	0.08
25	0.35	0.22	0.11	0.32	0.09
26	0.24	0.37	0.13	0.26	0.10
27	0.27	0.19	0.42	0.12	0.02
28	0.16	0.08	0.35	0.41	0.005
29	0.18	0.08	0.16	0.57	0.02
30	0.26	0.14	0.18	0.43	0.10
31	0.34	0.14	0.29	0.24	0.06
32	0.39	0.16	0.16	0.28	0.02
33	0.33	0.35	0.21	0.10	0.08
34	0.42	0.14	0.26	0.18	0.04
35	0.28	0.18	0.34	0.20	0.09
36	0.17	0.05	0.41	0.37	0.01
37	0.39	0.22	0.24	0.14	0.10
38	0.31	0.07	0.22	0.39	0.07
39	0.29	0.11	0.17	0.43	0.05
40	0.29	0.17	0.29	0.24	0.09
41	0.45	0.13	0.19	0.23	0.06
42	0.24	0.29	0.29	0.17	0.09
43	0.17	0.24	0.29	0.29	0.09
44	0.30	0.13	0.38	0.19	0.04
45	0.11	0.07	0.53	0.28	0.07
46	0.21	0.20	0.25	0.34	0.06
47	0.44	0.14	0.19	0.23	0.06
48	0.27	0.41	0.16	0.16	0.09
49	0.09	0.06	0.24	0.62	0.08
50	0.34	0.14	0.28	0.24	0.02
Weights	W_{31}	W_{32}	W_{33}	W_{34}	
50	0.30	0.18	0.24	0.28	

Table A4 Quality management:

Person number	Quality system	Quality of support service	Meeting regulatory requirements	Production facilities and capabilities	Reliability	Organisational leadership	CR
1	0.27	0.20	0.26	0.16	0.04	0.08	0.10
2	0.35	0.22	0.18	0.14	0.07	0.05	0.09
3	0.04	0.40	0.17	0.19	0.12	0.09	0.10
4	0.20	0.41	0.15	0.14	0.05	0.04	0.09
5	0.26	0.06	0.26	0.11	0.24	0.07	0.01
6	0.14	0.20	0.22	0.11	0.21	0.12	0.06
7	0.22	0.17	0.37	0.10	0.10	0.04	0.10
8	0.45	0.11	0.12	0.05	0.11	0.17	0.06
9	0.26	0.28	0.06	0.11	0.24	0.05	0.07
10	0.26	0.18	0.30	0.09	0.13	0.04	0.10
11	0.35	0.22	0.18	0.14	0.07	0.05	0.09
12	0.17	0.08	0.09	0.06	0.11	0.49	0.10
13	0.21	0.30	0.10	0.06	0.29	0.05	0.09
14	0.28	0.24	0.07	0.12	0.27	0.03	0.10
15	0.23	0.25	0.27	0.09	0.11	0.06	0.10
16	0.27	0.30	0.18	0.08	0.13	0.05	0.10
17	0.18	0.30	0.14	0.13	0.15	0.10	0.10
18	0.15	0.28	0.14	0.10	0.23	0.09	0.10
19	0.15	0.28	0.14	0.10	0.23	0.09	0.10
20	0.08	0.17	0.19	0.15	0.20	0.20	0.09
21	0.24	0.18	0.22	0.13	0.06	0.16	0.10
22	0.21	0.16	0.28	0.12	0.07	0.16	0.10
23	0.14	0.34	0.13	0.15	0.15	0.09	0.10
24	0.26	0.12	0.32	0.11	0.08	0.11	0.10
25	0.12	0.18	0.17	0.08	0.27	0.19	0.10
26	0.14	0.34	0.11	0.13	0.10	0.19	0.10
27	0.45	0.11	0.12	0.05	0.11	0.17	0.06
28	0.21	0.18	0.24	0.06	0.12	0.19	0.10
29	0.27	0.20	0.10	0.10	0.25	0.09	0.10
30	0.13	0.18	0.18	0.12	0.33	0.06	0.09
31	0.26	0.23	0.13	0.10	0.16	0.02	0.07
32	0.29	0.26	0.25	0.10	0.14	0.05	0.10
33	0.29	0.24	0.16	0.08	0.10	0.13	0.08
34	0.10	0.30	0.22	0.14	0.09	0.15	0.10
35	0.25	0.24	0.18	0.15	0.06	0.12	0.06
36	0.26	0.30	0.11	0.21	0.06	0.08	0.06
37	0.10	0.22	0.43	0.09	0.10	0.07	0.09
38	0.16	0.30	0.27	0.05	0.17	0.05	0.09
39	0.27	0.10	0.31	0.10	0.16	0.07	0.07
40	0.27	0.22	0.16	0.14	0.09	0.12	0.10

41	0.24	0.22	0.19	0.14	0.12	0.09	0.07
42	0.23	0.17	0.13	0.19	0.11	0.18	0.08
43	0.19	0.27	0.18	0.14	0.08	0.14	0.08
44	0.17	0.17	0.19	0.24	0.13	0.10	0.10
45	0.24	0.25	0.16	0.17	0.11	0.08	0.10
46	0.28	0.09	0.21	0.23	0.12	0.06	0.06
47	0.23	0.14	0.26	0.08	0.11	0.17	0.10
48	0.29	0.18	0.20	0.12	0.07	0.14	0.10
49	0.26	0.24	0.15	0.09	0.14	0.11	0.10
50	0.06	0.39	0.20	0.10	0.16	0.08	0.06
Weights	W_{41}	W_{42}	W_{43}	W_{44}	W_{45}	W_{46}	
Average	0.22	0.22	0.19	0.12	0.14	0.11	

Table A5 Process performance:

Person number	Bidding procedure	Technological system and technical support	Future manufacturing capability	Process capability	Design/process improvement	CR
1	0.08	0.27	0.07	0.25	0.34	0.05
2	0.16	0.29	0.07	0.33	0.15	0.09
3	0.54	0.23	0.04	0.12	0.07	0.07
4	0.05	0.26	0.11	0.23	0.35	0.09
5	0.07	0.29	0.08	0.20	0.36	0.10
6	0.06	0.43	0.21	0.21	0.09	0.08
7	0.33	0.13	0.30	0.17	0.08	0.07
8	0.29	0.36	0.14	0.07	0.14	0.10
9	0.06	0.45	0.11	0.20	0.17	0.10
10	0.05	0.30	0.21	0.10	0.34	0.07
11	0.09	0.31	0.04	0.12	0.43	0.10
12	0.16	0.36	0.10	0.31	0.07	0.10
13	0.46	0.29	0.10	0.06	0.09	0.08
14	0.07	0.27	0.27	0.28	0.12	0.10
15	0.19	0.27	0.18	0.31	0.06	0.10
16	0.09	0.22	0.06	0.23	0.39	0.06
17	0.09	0.26	0.05	0.36	0.24	0.07
18	0.08	0.20	0.17	0.44	0.11	0.10
19	0.05	0.35	0.10	0.16	0.34	0.07
20	0.13	0.20	0.05	0.21	0.40	0.09
21	0.19	0.36	0.21	0.19	0.05	0.10
22	0.29	0.41	0.11	0.15	0.04	0.09
23	0.32	0.40	0.07	0.09	0.12	0.05
24	0.06	0.47	0.08	0.25	0.15	0.10
25	0.07	0.25	0.05	0.20	0.43	0.08
26	0.06	0.45	0.11	0.17	0.21	0.06
27	0.34	0.30	0.20	0.09	0.07	0.10

28	0.07	0.43	0.04	0.30	0.15	0.10
29	0.09	0.35	0.14	0.27	0.15	0.10
30	0.08	0.30	0.08	0.12	0.43	0.09
31	0.08	0.40	0.13	0.09	0.30	0.10
32	0.05	0.42	0.19	0.25	0.09	0.08
33	0.28	0.38	0.18	0.11	0.05	0.07
34	0.18	0.27	0.09	0.07	0.39	0.08
35	0.25	0.41	0.16	0.13	0.05	0.10
36	0.08	0.33	0.13	0.36	0.09	0.10
37	0.08	0.46	0.12	0.23	0.11	0.09
38	0.07	0.36	0.07	0.11	0.39	0.05
39	0.05	0.29	0.12	0.17	0.36	0.10
40	0.05	0.35	0.12	0.16	0.31	0.06
41	0.06	0.42	0.12	0.26	0.13	0.09
42	0.43	0.12	0.25	0.13	0.07	0.08
43	0.09	0.16	0.05	0.51	0.19	0.10
44	0.18	0.10	0.24	0.28	0.21	0.10
45	0.05	0.43	0.09	0.31	0.12	0.09
46	0.04	0.34	0.14	0.33	0.16	0.08
47	0.28	0.30	0.25	0.11	0.06	0.09
48	0.21	0.41	0.04	0.23	0.12	0.10
49	0.20	0.37	0.24	0.12	0.07	0.09
50	0.14	0.09	0.05	0.23	0.48	0.07
Weights	W_{51}	W_{52}	W_{53}	W_{54}	W_{55}	
Average	0.15	0.32	0.13	0.21	0.20	

Table A6 Cultural factors:

Person number	Patriotism for same culture and beliefs	Location, local or foreign	Admire history and heritage	CR
1	0.23	0.67	0.10	0.07
2	0.64	0.07	0.28	0.06
3	0.62	0.14	0.24	0.02
4	0.09	0.48	0.42	0.02
5	0.26	0.33	0.41	0.05
6	0.10	0.51	0.39	0.07
7	0.69	0.18	0.14	0.07
8	0.33	0.26	0.41	0.05
9	0.49	0.14	0.37	0.08
10	0.10	0.37	0.53	0.08
11	0.19	0.23	0.58	0.05
12	0.08	0.26	0.66	0.03
13	0.61	0.12	0.27	0.06

14	0.09	0.74	0.17	0.01
15	0.72	0.17	0.11	0.08
16	0.16	0.73	0.11	0.11
17	0.59	0.08	0.33	0.01
18	0.50	0.11	0.40	0.05
19	0.26	0.41	0.33	0.05
20	0.07	0.55	0.37	0.07
21	0.15	0.67	0.18	0.05
22	0.74	0.17	0.09	0.01
23	0.69	0.16	0.15	0.01
24	0.52	0.14	0.33	0.05
25	0.09	0.27	0.64	0.05
26	0.10	0.15	0.75	0.07
27	0.12	0.13	0.75	0.01
28	0.61	0.12	0.27	0.02
29	0.47	0.38	0.15	0.05
30	0.07	0.55	0.37	0.07
31	0.15	0.13	0.72	0.03
32	0.10	0.17	0.72	0.03
33	0.66	0.26	0.08	0.03
34	0.66	0.19	0.16	0.03
35	0.11	0.40	0.50	0.05
36	0.49	0.20	0.31	0.05
37	0.50	0.11	0.40	0.05
38	0.26	0.33	0.41	0.05
39	0.10	0.28	0.62	0.07
40	0.23	0.10	0.67	0.07
41	0.59	0.25	0.16	0.05
42	0.56	0.35	0.09	0.05
43	0.38	0.08	0.54	0.10
44	0.15	0.67	0.18	0.05
45	0.68	0.13	0.19	0.08
46	0.09	0.41	0.50	0.03
47	0.49	0.31	0.20	0.05
48	0.37	0.10	0.53	0.08
49	0.74	0.10	0.16	0.05
50	0.15	0.75	0.09	0.03
Weights	W_{61}	W_{62}	W_{63}	
Average	0.36	0.29	0.35	

Table A7 Green practices:

Person number	Waste disposal schemes	Green procurement	Green technology/ operations	Green certifications	CR
1	0.11	0.52	0.32	0.05	0.04
2	0.41	0.14	0.37	0.07	0.07
3	0.08	0.60	0.23	0.09	0.07
4	0.26	0.12	0.56	0.07	0.09
5	0.09	0.22	0.09	0.61	0.02
6	0.55	0.19	0.07	0.19	0.10
7	0.09	0.47	0.32	0.11	0.09
8	0.21	0.07	0.62	0.11	0.06
9	0.12	0.52	0.29	0.07	0.10
10	0.24	0.08	0.26	0.41	0.10
11	0.08	0.20	0.19	0.52	0.07
12	0.57	0.09	0.07	0.26	0.06
13	0.48	0.32	0.07	0.13	0.08
14	0.35	0.45	0.15	0.06	0.05
15	0.15	0.49	0.29	0.07	0.07
16	0.15	0.49	0.27	0.09	0.10
17	0.60	0.13	0.21	0.07	0.10
18	0.23	0.56	0.14	0.06	0.08
19	0.06	0.38	0.13	0.43	0.06
20	0.12	0.51	0.22	0.16	0.05
21	0.47	0.28	0.10	0.15	0.08
22	0.13	0.34	0.14	0.39	0.05
23	0.50	0.30	0.07	0.13	0.06
24	0.21	0.33	0.39	0.07	0.06
25	0.22	0.11	0.27	0.41	0.05
26	0.19	0.07	0.47	0.28	0.06
27	0.36	0.20	0.07	0.37	0.09
28	0.30	0.39	0.13	0.18	0.06
29	0.24	0.49	0.21	0.07	0.09
30	0.07	0.08	0.45	0.40	0.06
31	0.07	0.20	0.25	0.48	0.08
32	0.57	0.14	0.08	0.21	0.10
33	0.07	0.35	0.23	0.34	0.04
34	0.48	0.27	0.12	0.14	0.07
35	0.37	0.27	0.32	0.07	0.06
36	0.17	0.39	0.36	0.08	0.06
37	0.20	0.50	0.23	0.07	0.08
38	0.22	0.46	0.06	0.26	0.08
39	0.09	0.19	0.14	0.58	0.10
40	0.54	0.15	0.10	0.21	0.09
41	0.19	0.43	0.29	0.09	0.10

42	0.42	0.36	0.16	0.06	0.10
43	0.53	0.13	0.25	0.08	0.08
44	0.30	0.39	0.18	0.13	0.06
45	0.33	0.32	0.30	0.05	0.01
46	0.51	0.28	0.05	0.16	0.07
47	0.04	0.51	0.22	0.22	0.06
48	0.57	0.09	0.10	0.24	0.09
49	0.35	0.39	0.18	0.08	0.08
50	0.34	0.47	0.11	0.08	0.06
Weights	W_{71}	W_{72}	W_{73}	W_{74}	
Average	0.28	0.31	0.22	0.19	

Table A8 CSR:

Person number	Ethical behaviour	Philanthropic responsibility	Social sustainability	Environmental sustainability	Economic sustainability	CR
1	0.24	0.14	0.10	0.19	0.33	0.09
2	0.19	0.19	0.15	0.26	0.22	0.09
3	0.20	0.10	0.26	0.30	0.15	0.06
4	0.09	0.06	0.27	0.36	0.22	0.09
5	0.16	0.13	0.19	0.31	0.21	0.06
6	0.15	0.09	0.27	0.34	0.15	0.06
7	0.23	0.11	0.22	0.18	0.26	0.09
8	0.16	0.21	0.18	0.22	0.23	0.10
9	0.25	0.14	0.14	0.31	0.15	0.10
10	0.18	0.12	0.28	0.22	0.20	0.09
11	0.09	0.06	0.28	0.31	0.26	0.10
12	0.20	0.12	0.19	0.28	0.20	0.08
13	0.23	0.16	0.12	0.26	0.23	0.09
14	0.15	0.18	0.15	0.24	0.29	0.10
15	0.24	0.09	0.20	0.33	0.15	0.10
16	0.20	0.05	0.09	0.27	0.39	0.08
17	0.21	0.11	0.05	0.36	0.26	0.10
18	0.29	0.14	0.12	0.35	0.10	0.09
19	0.12	0.13	0.27	0.27	0.22	0.10
20	0.07	0.04	0.32	0.34	0.23	0.06
21	0.24	0.15	0.21	0.27	0.13	0.09
22	0.27	0.12	0.18	0.21	0.22	0.10
23	0.19	0.20	0.15	0.22	0.23	0.08
24	0.19	0.17	0.20	0.29	0.15	0.09
25	0.14	0.11	0.24	0.27	0.24	0.09
26	0.08	0.04	0.34	0.29	0.25	0.10
27	0.16	0.06	0.33	0.28	0.17	0.08
28	0.25	0.14	0.21	0.26	0.14	0.10
29	0.22	0.20	0.19	0.26	0.13	0.09
30	0.11	0.06	0.33	0.29	0.20	0.05

31	0.12	0.09	0.30	0.26	0.22	0.10
32	0.19	0.08	0.27	0.33	0.13	0.07
33	0.25	0.18	0.27	0.13	0.16	0.08
34	0.26	0.15	0.15	0.25	0.19	0.08
35	0.22	0.17	0.15	0.28	0.18	0.06
36	0.18	0.09	0.22	0.35	0.15	0.10
37	0.29	0.16	0.11	0.33	0.11	0.09
38	0.08	0.08	0.35	0.35	0.14	0.10
39	0.12	0.12	0.23	0.27	0.26	0.07
40	0.17	0.12	0.21	0.36	0.14	0.09
41	0.25	0.15	0.19	0.23	0.19	0.09
42	0.26	0.18	0.19	0.15	0.22	0.09
43	0.13	0.15	0.06	0.30	0.37	0.09
44	0.16	0.10	0.19	0.37	0.18	0.04
45	0.22	0.15	0.17	0.34	0.12	0.10
46	0.16	0.11	0.23	0.35	0.16	0.05
47	0.26	0.18	0.19	0.17	0.19	0.09
48	0.30	0.05	0.12	0.22	0.31	0.08
49	0.25	0.21	0.13	0.23	0.19	0.10
50	0.25	0.13	0.11	0.26	0.25	0.08
Weights	W_{81}	W_{82}	W_{83}	W_{84}	W_{85}	
Average	0.19	0.13	0.20	0.28	0.20	

Table A9 Logistics performance:

Person number	Location	Geographical distance	Packaging	Post-production configuration /ease of assembly	Hazardous goods management	CR
1	0.33	0.06	0.09	0.19	0.34	0.09
2	0.12	0.28	0.16	0.22	0.23	0.08
3	0.28	0.20	0.11	0.10	0.32	0.05
4	0.10	0.10	0.18	0.33	0.28	0.08
5	0.27	0.14	0.14	0.16	0.29	0.08
6	0.07	0.12	0.08	0.21	0.52	0.09
7	0.06	0.06	0.10	0.45	0.33	0.07
8	0.24	0.35	0.15	0.11	0.15	0.04
9	0.33	0.25	0.15	0.11	0.16	0.09
10	0.24	0.20	0.16	0.20	0.20	0.10
11	0.16	0.28	0.15	0.24	0.17	0.10
12	0.14	0.14	0.20	0.25	0.27	0.09
13	0.38	0.23	0.17	0.10	0.14	0.09
14	0.10	0.27	0.14	0.24	0.25	0.09
15	0.22	0.22	0.15	0.15	0.27	0.07

16	0.38	0.16	0.08	0.18	0.20	0.06
17	0.32	0.22	0.09	0.20	0.17	0.07
18	0.22	0.20	0.17	0.15	0.26	0.09
19	0.13	0.22	0.22	0.21	0.23	0.10
20	0.25	0.19	0.12	0.28	0.15	0.04
21	0.15	0.15	0.15	0.27	0.27	0.07
22	0.22	0.20	0.22	0.19	0.17	0.08
23	0.29	0.25	0.16	0.15	0.15	0.08
24	0.24	0.27	0.16	0.16	0.18	0.09
25	0.12	0.18	0.09	0.41	0.20	0.01
26	0.10	0.09	0.08	0.35	0.39	0.06
27	0.16	0.14	0.09	0.28	0.32	0.07
28	0.30	0.23	0.17	0.12	0.17	0.08
29	0.27	0.15	0.16	0.14	0.29	0.09
30	0.22	0.17	0.21	0.25	0.15	0.09
31	0.11	0.15	0.14	0.31	0.29	0.08
32	0.10	0.19	0.24	0.19	0.29	0.08
33	0.12	0.09	0.22	0.30	0.27	0.10
34	0.31	0.26	0.15	0.14	0.13	0.08
35	0.16	0.23	0.12	0.30	0.18	0.10
36	0.16	0.21	0.12	0.15	0.36	0.07
37	0.24	0.16	0.07	0.15	0.39	0.09
38	0.23	0.12	0.11	0.32	0.21	0.06
39	0.09	0.08	0.11	0.45	0.27	0.04
40	0.26	0.22	0.19	0.19	0.13	0.07
41	0.31	0.14	0.08	0.12	0.34	0.07
42	0.17	0.08	0.09	0.32	0.35	0.06
43	0.14	0.20	0.26	0.23	0.17	0.07
44	0.19	0.16	0.15	0.24	0.25	0.09
45	0.26	0.23	0.18	0.17	0.17	0.07
46	0.25	0.20	0.17	0.18	0.20	0.08
47	0.21	0.05	0.14	0.29	0.32	0.09
48	0.25	0.24	0.23	0.11	0.16	0.07
49	0.27	0.22	0.10	0.12	0.30	0.08
50	0.27	0.25	0.09	0.22	0.17	0.07
Weights	W_{91}	W_{92}	W_{93}	W_{94}	W_{95}	
Average	0.21	0.18	0.15	0.22	0.24	

Table B AHP output Weights of the main criteria (UAE sample with CR of '10% or less')

Person number	Supplier experience	Supplier financial position	Communication & responsiveness	Quality management	Process performance	Supplier cultural factors	Supplier green practices	CSR	Supplier logistics performance	CR
1	0.16	0.16	0.18	0.23	0.10	0.08	0.05	0.03	0.03	0.10
2	0.16	0.17	0.18	0.21	0.07	0.09	0.07	0.03	0.03	0.10
3	0.12	0.08	0.20	0.22	0.05	0.06	0.08	0.13	0.06	0.09
4	0.13	0.14	0.15	0.28	0.08	0.11	0.07	0.03	0.02	0.09
5	0.13	0.09	0.17	0.25	0.09	0.07	0.04	0.05	0.10	0.10
6	0.06	0.12	0.20	0.17	0.19	0.04	0.03	0.02	0.16	0.10
7	0.16	0.06	0.03	0.28	0.09	0.03	0.19	0.09	0.06	0.10
8	0.08	0.14	0.08	0.24	0.04	0.05	0.14	0.13	0.11	0.10
9	0.08	0.14	0.10	0.26	0.03	0.07	0.10	0.16	0.07	0.10
10	0.15	0.06	0.03	0.26	0.10	0.04	0.20	0.10	0.06	0.08
11	0.17	0.16	0.06	0.13	0.08	0.12	0.12	0.10	0.08	0.10
12	0.11	0.10	0.16	0.18	0.12	0.05	0.09	0.08	0.12	0.10
13	0.12	0.17	0.07	0.25	0.16	0.08	0.04	0.05	0.06	0.10
14	0.09	0.10	0.12	0.17	0.06	0.14	0.08	0.11	0.13	0.10
15	0.15	0.19	0.13	0.15	0.10	0.12	0.08	0.05	0.03	0.10
16	0.14	0.13	0.10	0.16	0.09	0.14	0.08	0.07	0.10	0.10
17	0.07	0.13	0.14	0.19	0.05	0.14	0.10	0.11	0.06	0.10
18	0.11	0.16	0.14	0.17	0.12	0.10	0.08	0.05	0.07	0.10
19	0.13	0.07	0.13	0.14	0.12	0.07	0.11	0.06	0.16	0.10
20	0.08	0.21	0.13	0.13	0.08	0.07	0.11	0.06	0.14	0.10
21	0.12	0.10	0.05	0.22	0.11	0.07	0.15	0.09	0.09	0.10
22	0.15	0.08	0.11	0.18	0.07	0.08	0.12	0.11	0.10	0.08
23	0.10	0.07	0.13	0.17	0.11	0.08	0.12	0.08	0.14	0.10
24	0.10	0.09	0.08	0.15	0.16	0.06	0.13	0.11	0.13	0.10

25	0.11	0.16	0.08	0.25	0.05	0.07	0.09	0.11	0.07	0.08
26	0.11	0.10	0.12	0.18	0.08	0.07	0.12	0.09	0.12	0.10
27	0.11	0.10	0.09	0.17	0.11	0.06	0.14	0.12	0.10	0.10
28	0.09	0.16	0.09	0.15	0.11	0.13	0.07	0.14	0.06	0.10
29	0.11	0.15	0.12	0.17	0.05	0.06	0.13	0.10	0.11	0.10
30	0.14	0.09	0.12	0.17	0.05	0.09	0.07	0.08	0.19	0.10
31	0.10	0.07	0.11	0.13	0.09	0.09	0.12	0.13	0.15	0.10
32	0.10	0.08	0.14	0.11	0.10	0.06	0.15	0.10	0.14	0.10
33	0.09	0.16	0.17	0.11	0.13	0.05	0.12	0.07	0.10	0.10
34	0.07	0.15	0.13	0.14	0.11	0.09	0.07	0.16	0.08	0.10
35	0.12	0.15	0.10	0.16	0.07	0.11	0.09	0.12	0.08	0.10
36	0.14	0.07	0.14	0.20	0.13	0.06	0.09	0.08	0.10	0.08
37	0.16	0.11	0.09	0.19	0.12	0.08	0.06	0.10	0.10	0.10
38	0.10	0.18	0.12	0.14	0.08	0.08	0.11	0.09	0.09	0.10
39	0.16	0.13	0.12	0.18	0.08	0.06	0.09	0.06	0.12	0.10
40	0.13	0.12	0.15	0.20	0.10	0.06	0.07	0.08	0.08	0.10
41	0.10	0.08	0.14	0.17	0.07	0.09	0.14	0.09	0.12	0.10
42	0.06	0.15	0.14	0.17	0.12	0.05	0.09	0.08	0.14	0.10
43	0.11	0.10	0.12	0.20	0.08	0.08	0.16	0.08	0.07	0.10
44	0.10	0.21	0.10	0.12	0.08	0.07	0.13	0.12	0.07	0.10
45	0.12	0.09	0.08	0.20	0.09	0.11	0.11	0.12	0.07	0.10
46	0.13	0.10	0.13	0.16	0.08	0.10	0.07	0.09	0.13	0.10
47	0.14	0.09	0.14	0.15	0.11	0.11	0.10	0.12	0.04	0.10
48	0.08	0.14	0.10	0.16	0.07	0.15	0.11	0.14	0.05	0.10
49	0.09	0.07	0.15	0.11	0.08	0.11	0.12	0.11	0.16	0.10
50	0.13	0.08	0.03	0.20	0.14	0.06	0.14	0.15	0.07	0.10
Weights	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8	W_9	
Average	0.12	0.12	0.12	0.18	0.09	0.08	0.10	0.09	0.09	

- AHP output: Weights of the sub-criteria (UAE sample with CR of '10% or less')

Table B1 Supplier experience:

Person number	Performance history & delivery	Reputation	Innovation & creativity	Amount of past business	Marketing position	Supplier expertise	CR
1	0.31	0.33	0.17	0.09	0.06	0.04	0.09
2	0.35	0.23	0.18	0.11	0.07	0.05	0.10
3	0.08	0.22	0.16	0.09	0.26	0.19	0.10
4	0.42	0.22	0.16	0.09	0.08	0.04	0.10
5	0.30	0.21	0.08	0.10	0.05	0.25	0.07
6	0.51	0.07	0.05	0.13	0.04	0.20	0.10
7	0.37	0.09	0.25	0.06	0.08	0.16	0.10
8	0.30	0.07	0.16	0.03	0.26	0.17	0.10
9	0.11	0.39	0.06	0.05	0.24	0.16	0.10
10	0.37	0.10	0.25	0.05	0.06	0.17	0.09
11	0.03	0.42	0.07	0.26	0.09	0.12	0.10
12	0.04	0.25	0.23	0.11	0.29	0.07	0.10
13	0.16	0.11	0.43	0.03	0.22	0.06	0.09
14	0.22	0.03	0.33	0.14	0.16	0.13	0.07
15	0.24	0.38	0.11	0.15	0.06	0.06	0.10
16	0.33	0.27	0.17	0.07	0.11	0.05	0.10
17	0.10	0.18	0.20	0.17	0.17	0.18	0.10
18	0.31	0.26	0.16	0.11	0.11	0.04	0.10
19	0.30	0.20	0.13	0.12	0.09	0.15	0.10
20	0.33	0.15	0.08	0.06	0.07	0.30	0.10
21	0.35	0.11	0.17	0.08	0.10	0.18	0.09
22	0.29	0.11	0.19	0.10	0.18	0.13	0.10
23	0.29	0.25	0.09	0.07	0.15	0.15	0.10
24	0.31	0.12	0.23	0.11	0.12	0.11	0.10
25	0.30	0.18	0.11	0.14	0.10	0.18	0.09
26	0.26	0.15	0.10	0.10	0.21	0.17	0.10
27	0.18	0.19	0.21	0.07	0.14	0.21	0.10
28	0.18	0.20	0.17	0.10	0.13	0.22	0.09
29	0.24	0.24	0.11	0.19	0.07	0.15	0.10
30	0.13	0.15	0.20	0.10	0.16	0.24	0.10
31	0.13	0.31	0.12	0.22	0.07	0.14	0.09
32	0.28	0.07	0.21	0.19	0.12	0.13	0.10
33	0.19	0.22	0.15	0.16	0.15	0.12	0.10
34	0.18	0.17	0.26	0.14	0.13	0.12	0.10
35	0.22	0.25	0.16	0.17	0.14	0.06	0.10

36	0.17	0.34	0.15	0.13	0.09	0.12	0.09
37	0.22	0.22	0.16	0.14	0.18	0.08	0.10
38	0.30	0.31	0.16	0.07	0.10	0.06	0.10
39	0.21	0.17	0.14	0.12	0.22	0.14	0.10
40	0.19	0.16	0.22	0.17	0.18	0.08	0.10
41	0.19	0.16	0.18	0.20	0.17	0.10	0.09
42	0.21	0.21	0.19	0.15	0.10	0.14	0.10
43	0.26	0.14	0.20	0.18	0.10	0.12	0.09
44	0.24	0.11	0.22	0.11	0.10	0.22	0.10
45	0.22	0.19	0.14	0.07	0.14	0.26	0.10
46	0.39	0.18	0.11	0.07	0.11	0.14	0.10
47	0.29	0.17	0.09	0.13	0.13	0.19	0.09
48	0.23	0.16	0.23	0.10	0.07	0.21	0.10
49	0.32	0.17	0.11	0.10	0.17	0.14	0.09
50	0.16	0.18	0.09	0.11	0.24	0.22	0.10
Weights	W_{11}	W_{12}	W_{13}	W_{14}	W_{15}	W_{16}	
Average	0.25	0.20	0.17	0.12	0.13	0.14	

Table B2 Financial position:

Person number	Financial stability	Cost and price	Desire for business	Quantity discount	Warranty & aftersales services	CR
1	0.40	0.26	0.14	0.11	0.10	0.08
2	0.43	0.28	0.13	0.09	0.07	0.08
3	0.23	0.27	0.18	0.15	0.16	0.11
4	0.43	0.20	0.17	0.10	0.10	0.09
5	0.17	0.44	0.06	0.17	0.17	0.01
6	0.33	0.31	0.14	0.08	0.13	0.11
7	0.49	0.21	0.08	0.06	0.16	0.05
8	0.28	0.21	0.20	0.09	0.23	0.11
9	0.38	0.20	0.05	0.13	0.24	0.11
10	0.41	0.32	0.06	0.09	0.12	0.03
11	0.32	0.19	0.10	0.06	0.33	0.11
12	0.16	0.09	0.43	0.08	0.24	0.07
13	0.31	0.25	0.07	0.12	0.24	0.09
14	0.26	0.30	0.07	0.26	0.11	0.10
15	0.30	0.28	0.20	0.14	0.08	0.10
16	0.22	0.26	0.22	0.17	0.13	0.06
17	0.25	0.23	0.27	0.13	0.12	0.10
18	0.38	0.19	0.17	0.14	0.12	0.10

19	0.36	0.27	0.10	0.15	0.13	0.11
20	0.18	0.39	0.17	0.16	0.10	0.09
21	0.51	0.17	0.13	0.07	0.13	0.03
22	0.20	0.10	0.17	0.26	0.27	0.10
23	0.33	0.22	0.16	0.09	0.20	0.09
24	0.22	0.31	0.21	0.11	0.15	0.10
25	0.37	0.19	0.07	0.11	0.25	0.07
26	0.29	0.25	0.11	0.22	0.13	0.09
27	0.16	0.13	0.19	0.23	0.30	0.11
28	0.35	0.20	0.08	0.11	0.26	0.09
29	0.25	0.27	0.08	0.15	0.25	0.06
30	0.32	0.15	0.14	0.16	0.24	0.09
31	0.34	0.21	0.12	0.20	0.14	0.10
32	0.15	0.31	0.23	0.16	0.15	0.11
33	0.20	0.34	0.09	0.20	0.17	0.10
34	0.36	0.20	0.15	0.17	0.12	0.10
35	0.36	0.17	0.14	0.20	0.13	0.08
36	0.35	0.23	0.14	0.13	0.15	0.10
37	0.18	0.24	0.21	0.10	0.28	0.10
38	0.34	0.23	0.13	0.12	0.19	0.10
39	0.19	0.32	0.21	0.10	0.17	0.09
40	0.19	0.30	0.26	0.10	0.15	0.10
41	0.27	0.37	0.12	0.07	0.18	0.10
42	0.42	0.18	0.14	0.10	0.17	0.10
43	0.39	0.16	0.18	0.13	0.14	0.08
44	0.25	0.24	0.14	0.14	0.23	0.09
45	0.21	0.22	0.22	0.17	0.17	0.10
46	0.18	0.35	0.06	0.29	0.12	0.05
47	0.31	0.15	0.26	0.12	0.16	0.07
48	0.29	0.19	0.16	0.08	0.28	0.09
49	0.30	0.21	0.17	0.10	0.23	0.11
50	0.24	0.21	0.16	0.13	0.25	0.08
Weights	W_{21}	W_{22}	W_{23}	W_{24}	W_{25}	
Average	0.30	0.24	0.15	0.14	0.18	

Table B3 Communication and responsiveness:

Person number	Ability to fill emergency orders	Response to change	Process flexibility	Customer service	CR
1	0.46	0.31	0.15	0.08	0.06
2	0.16	0.42	0.21	0.21	0.07
3	0.41	0.22	0.27	0.10	0.03
4	0.12	0.17	0.33	0.38	0.07
5	0.29	0.34	0.17	0.20	0.02
6	0.46	0.22	0.20	0.12	0.01
7	0.20	0.14	0.45	0.21	0.06
8	0.33	0.14	0.33	0.20	0.02
9	0.11	0.16	0.28	0.45	0.02
10	0.20	0.14	0.45	0.21	0.06
11	0.42	0.08	0.17	0.33	0.04
12	0.36	0.13	0.32	0.19	0.01
13	0.16	0.26	0.48	0.10	0.07
14	0.42	0.21	0.21	0.16	0.07
15	0.09	0.25	0.39	0.27	0.07
16	0.42	0.20	0.24	0.15	0.05
17	0.33	0.35	0.14	0.18	0.07
18	0.34	0.30	0.16	0.19	0.11
19	0.36	0.36	0.14	0.14	0.01
20	0.39	0.16	0.28	0.16	0.02
21	0.44	0.15	0.29	0.12	0.07
22	0.20	0.34	0.18	0.28	0.09
23	0.28	0.15	0.32	0.25	0.10
24	0.34	0.20	0.14	0.32	0.06
25	0.10	0.20	0.32	0.37	0.08
26	0.48	0.16	0.12	0.24	0.08
27	0.36	0.11	0.32	0.21	0.10
28	0.14	0.23	0.22	0.41	0.08
29	0.41	0.13	0.22	0.24	0.09
30	0.06	0.25	0.43	0.25	0.02
31	0.22	0.15	0.35	0.28	0.10
32	0.44	0.16	0.15	0.25	0.09
33	0.36	0.31	0.12	0.22	0.09
34	0.26	0.19	0.38	0.17	0.10
35	0.38	0.23	0.29	0.10	0.10
36	0.07	0.38	0.14	0.41	0.02
37	0.38	0.08	0.22	0.32	0.03
38	0.40	0.20	0.09	0.32	0.05

39	0.28	0.44	0.17	0.11	0.02
40	0.40	0.23	0.26	0.10	0.07
41	0.28	0.27	0.12	0.33	0.07
42	0.22	0.26	0.09	0.42	0.05
43	0.19	0.06	0.18	0.57	0.08
44	0.20	0.13	0.18	0.49	0.10
45	0.19	0.40	0.17	0.24	0.06
46	0.17	0.25	0.33	0.25	0.07
47	0.23	0.25	0.16	0.36	0.10
48	0.24	0.39	0.22	0.14	0.10
49	0.25	0.13	0.42	0.20	0.05
50	0.44	0.16	0.15	0.25	0.09
Weights	W_{31}	W_{32}	W_{33}	W_{34}	
Average	0.29	0.22	0.24	0.25	

Table B4 Quality management:

Person number	Quality system	Quality of support service	Meeting regulatory requirements	Production facilities and capabilities	Reliability	Organisational leadership	CR
1	0.37	0.28	0.13	0.10	0.04	0.09	0.10
2	0.34	0.27	0.15	0.12	0.06	0.06	0.09
3	0.16	0.24	0.23	0.08	0.14	0.15	0.10
4	0.25	0.42	0.11	0.08	0.05	0.09	0.09
5	0.24	0.07	0.26	0.11	0.20	0.12	0.09
6	0.14	0.20	0.22	0.11	0.21	0.12	0.06
7	0.22	0.17	0.36	0.09	0.12	0.04	0.10
8	0.18	0.12	0.39	0.06	0.21	0.04	0.10
9	0.24	0.28	0.09	0.12	0.23	0.04	0.10
10	0.21	0.18	0.34	0.09	0.12	0.06	0.08
11	0.18	0.30	0.12	0.19	0.11	0.10	0.10
12	0.18	0.20	0.17	0.14	0.24	0.07	0.10
13	0.21	0.31	0.11	0.07	0.25	0.05	0.08
14	0.24	0.27	0.07	0.11	0.14	0.16	0.11
15	0.25	0.26	0.12	0.11	0.16	0.10	0.10
16	0.23	0.28	0.16	0.12	0.14	0.08	0.08
17	0.25	0.22	0.12	0.14	0.20	0.07	0.11
18	0.21	0.33	0.17	0.10	0.13	0.07	0.11
19	0.20	0.12	0.29	0.13	0.11	0.15	0.10
20	0.07	0.23	0.29	0.13	0.17	0.13	0.07

21	0.33	0.13	0.21	0.13	0.06	0.14	0.10
22	0.32	0.10	0.24	0.13	0.12	0.09	0.11
23	0.15	0.28	0.16	0.22	0.12	0.07	0.10
24	0.24	0.23	0.17	0.19	0.07	0.10	0.10
25	0.21	0.14	0.19	0.06	0.30	0.09	0.10
26	0.20	0.31	0.09	0.15	0.16	0.09	0.06
27	0.36	0.13	0.26	0.05	0.09	0.11	0.06
28	0.23	0.12	0.25	0.17	0.16	0.08	0.11
29	0.24	0.32	0.11	0.15	0.12	0.07	0.08
30	0.20	0.17	0.15	0.07	0.34	0.08	0.10
31	0.27	0.18	0.11	0.23	0.14	0.06	0.11
32	0.27	0.17	0.22	0.19	0.09	0.06	0.10
33	0.15	0.38	0.12	0.11	0.14	0.10	0.10
34	0.15	0.34	0.14	0.20	0.07	0.11	0.10
35	0.20	0.29	0.21	0.17	0.09	0.05	0.09
36	0.14	0.42	0.12	0.15	0.09	0.08	0.11
37	0.12	0.29	0.13	0.18	0.16	0.12	0.11
38	0.10	0.23	0.21	0.14	0.22	0.10	0.10
39	0.21	0.10	0.21	0.18	0.20	0.11	0.10
40	0.14	0.35	0.18	0.06	0.15	0.12	0.10
41	0.23	0.14	0.31	0.10	0.12	0.11	0.09
42	0.20	0.17	0.34	0.11	0.12	0.06	0.11
43	0.15	0.29	0.11	0.23	0.09	0.13	0.07
44	0.13	0.17	0.32	0.08	0.19	0.10	0.10
45	0.27	0.16	0.24	0.12	0.15	0.06	0.09
46	0.32	0.09	0.13	0.22	0.13	0.10	0.10
47	0.22	0.10	0.25	0.13	0.14	0.15	0.10
48	0.12	0.29	0.15	0.18	0.18	0.09	0.07
49	0.28	0.07	0.25	0.13	0.22	0.06	0.08
50	0.11	0.35	0.13	0.09	0.19	0.12	0.10
Weights	W_{41}	W_{42}	W_{43}	W_{44}	W_{45}	W_{46}	
Average	0.21	0.23	0.19	0.13	0.15	0.09	

Table B5 Process performance:

Person number	Bidding procedure	Techno-logical system and technical support	Future manufacturing capability	Process capability	Design/ process improvement	CR
1	0.17	0.24	0.15	0.28	0.16	0.10
2	0.14	0.28	0.29	0.09	0.20	0.07
3	0.24	0.29	0.19	0.20	0.07	0.10
4	0.21	0.23	0.30	0.17	0.09	0.10
5	0.21	0.23	0.17	0.14	0.25	0.07
6	0.12	0.24	0.12	0.36	0.16	0.08
7	0.04	0.34	0.15	0.31	0.15	0.09
8	0.11	0.27	0.10	0.19	0.33	0.06
9	0.06	0.25	0.08	0.47	0.14	0.08
10	0.04	0.35	0.12	0.31	0.18	0.06
11	0.10	0.34	0.06	0.32	0.18	0.10
12	0.27	0.12	0.30	0.19	0.12	0.05
13	0.08	0.21	0.06	0.22	0.43	0.10
14	0.05	0.10	0.40	0.30	0.15	0.09
15	0.20	0.22	0.18	0.32	0.09	0.09
16	0.34	0.22	0.20	0.10	0.14	0.07
17	0.34	0.23	0.21	0.13	0.10	0.09
18	0.25	0.24	0.13	0.30	0.08	0.10
19	0.21	0.20	0.23	0.11	0.25	0.04
20	0.26	0.16	0.20	0.30	0.08	0.06
21	0.07	0.28	0.17	0.35	0.13	0.05
22	0.16	0.20	0.17	0.15	0.31	0.11
23	0.17	0.25	0.23	0.26	0.08	0.10
24	0.18	0.18	0.12	0.34	0.16	0.09
25	0.11	0.22	0.14	0.40	0.13	0.10
26	0.18	0.20	0.09	0.24	0.28	0.09
27	0.06	0.20	0.11	0.34	0.30	0.10
28	0.09	0.33	0.16	0.32	0.10	0.07
29	0.23	0.13	0.30	0.25	0.09	0.09
30	0.12	0.36	0.14	0.25	0.13	0.10
31	0.11	0.14	0.41	0.20	0.13	0.10
32	0.18	0.15	0.34	0.24	0.09	0.08
33	0.09	0.11	0.26	0.40	0.14	0.09
34	0.23	0.16	0.09	0.11	0.41	0.10
35	0.21	0.34	0.17	0.20	0.08	0.06

36	0.22	0.34	0.20	0.14	0.10	0.06
37	0.19	0.16	0.35	0.08	0.22	0.09
38	0.37	0.21	0.18	0.08	0.17	0.10
39	0.20	0.30	0.18	0.08	0.24	0.08
40	0.24	0.38	0.09	0.18	0.11	0.06
41	0.21	0.27	0.25	0.08	0.18	0.10
42	0.33	0.30	0.15	0.13	0.09	0.11
43	0.20	0.19	0.08	0.33	0.21	0.09
44	0.11	0.44	0.08	0.19	0.18	0.06
45	0.10	0.11	0.15	0.44	0.20	0.08
46	0.18	0.19	0.22	0.34	0.08	0.08
47	0.17	0.36	0.08	0.24	0.15	0.10
48	0.16	0.18	0.32	0.25	0.08	0.09
49	0.22	0.14	0.12	0.34	0.18	0.10
50	0.13	0.20	0.33	0.23	0.10	0.10
Weights	W_{51}	W_{52}	W_{53}	W_{54}	W_{55}	
Average	0.17	0.24	0.19	0.24	0.16	

Table B6 Cultural factors:

Person number	Patriotism for same culture and beliefs	Location, local or foreign	Admire history and heritage	CR
1	0.09	0.56	0.35	0.05
2	0.26	0.41	0.33	0.05
3	0.35	0.09	0.56	0.05
4	0.56	0.35	0.09	0.05
5	0.44	0.17	0.39	0.02
6	0.33	0.41	0.26	0.05
7	0.63	0.11	0.26	0.03
8	0.52	0.33	0.14	0.05
9	0.49	0.37	0.14	0.08
10	0.63	0.11	0.26	0.03
11	0.08	0.56	0.36	0.05
12	0.09	0.56	0.35	0.05
13	0.52	0.14	0.33	0.05
14	0.70	0.18	0.11	0.05
15	0.26	0.33	0.41	0.05
16	0.38	0.47	0.15	0.05
17	0.39	0.17	0.44	0.02
18	0.60	0.23	0.17	0.08
19	0.62	0.24	0.14	0.02
20	0.49	0.14	0.37	0.08

21	0.67	0.23	0.10	0.07
22	0.17	0.60	0.23	0.08
23	0.55	0.21	0.24	0.02
24	0.39	0.17	0.44	0.02
25	0.37	0.49	0.14	0.08
26	0.58	0.19	0.23	0.05
27	0.44	0.17	0.39	0.02
28	0.12	0.56	0.32	0.02
29	0.35	0.56	0.09	0.05
30	0.56	0.32	0.12	0.02
31	0.58	0.19	0.23	0.05
32	0.16	0.22	0.62	0.09
33	0.63	0.17	0.19	0.01
34	0.22	0.62	0.16	0.09
35	0.26	0.41	0.33	0.05
36	0.68	0.20	0.12	0.02
37	0.13	0.66	0.21	0.05
38	0.33	0.41	0.26	0.05
39	0.41	0.26	0.33	0.05
40	0.62	0.22	0.16	0.09
41	0.23	0.17	0.60	0.08
42	0.41	0.33	0.26	0.05
43	0.47	0.38	0.15	0.05
44	0.44	0.39	0.17	0.02
45	0.16	0.66	0.19	0.03
46	0.53	0.10	0.37	0.08
47	0.17	0.23	0.60	0.08
48	0.53	0.10	0.37	0.08
49	0.17	0.63	0.19	0.01
50	0.15	0.47	0.38	0.05
Weights	W_{61}	W_{62}	W_{63}	
Average	0.40	0.33	0.28	

Table B7 Green practices:

Person number	Waste disposal schemes	Green procurement	Green technology/ operations	Green certifications	CR
1	0.19	0.08	0.12	0.60	0.05
2	0.31	0.20	0.06	0.42	0.09
3	0.07	0.51	0.13	0.29	0.02
4	0.45	0.31	0.18	0.06	0.08
5	0.33	0.15	0.36	0.16	0.01
6	0.24	0.18	0.18	0.41	0.06
7	0.21	0.45	0.29	0.06	0.09
8	0.17	0.49	0.27	0.08	0.07
9	0.60	0.15	0.19	0.06	0.05
10	0.24	0.45	0.23	0.08	0.08
11	0.09	0.42	0.22	0.26	0.10
12	0.22	0.41	0.11	0.27	0.05
13	0.16	0.52	0.11	0.20	0.09
14	0.07	0.35	0.45	0.13	0.04
15	0.23	0.12	0.31	0.33	0.08
16	0.17	0.31	0.14	0.38	0.09
17	0.10	0.35	0.27	0.28	0.10
18	0.45	0.24	0.17	0.14	0.08
19	0.56	0.14	0.17	0.12	0.02
20	0.49	0.15	0.25	0.12	0.05
21	0.24	0.32	0.38	0.07	0.02
22	0.13	0.43	0.32	0.11	0.07
23	0.50	0.08	0.21	0.20	0.08
24	0.36	0.18	0.14	0.32	0.04
25	0.50	0.29	0.14	0.07	0.10
26	0.12	0.49	0.24	0.14	0.11
27	0.33	0.38	0.12	0.17	0.08
28	0.34	0.18	0.10	0.37	0.08
29	0.15	0.30	0.44	0.11	0.06
30	0.12	0.32	0.46	0.10	0.03
31	0.10	0.37	0.10	0.42	0.01
32	0.23	0.14	0.11	0.52	0.08
33	0.41	0.32	0.12	0.15	0.08
34	0.08	0.18	0.42	0.32	0.03
35	0.14	0.47	0.17	0.22	0.11
36	0.10	0.50	0.30	0.10	0.06
37	0.12	0.34	0.20	0.34	0.08

38	0.37	0.14	0.09	0.39	0.08
39	0.20	0.13	0.56	0.12	0.10
40	0.06	0.49	0.26	0.19	0.08
41	0.17	0.42	0.19	0.23	0.08
42	0.50	0.25	0.10	0.15	0.07
43	0.50	0.14	0.20	0.16	0.07
44	0.29	0.38	0.21	0.12	0.08
45	0.29	0.49	0.10	0.12	0.07
46	0.27	0.10	0.50	0.13	0.04
47	0.16	0.14	0.58	0.12	0.03
48	0.44	0.20	0.28	0.09	0.09
49	0.46	0.21	0.23	0.10	0.07
50	0.27	0.51	0.17	0.05	0.09
Weights	W_{71}	W_{72}	W_{73}	W_{74}	
Average	0.27	0.30	0.23	0.20	

Table B8 CSR:

Person number	Ethical behaviour	Philanthropic responsibility	Social sustainability	Environmental sustainability	Economic sustainability	CR
1	0.29	0.22	0.17	0.18	0.14	0.09
2	0.21	0.10	0.29	0.22	0.19	0.08
3	0.17	0.12	0.19	0.20	0.31	0.09
4	0.36	0.25	0.16	0.13	0.11	0.08
5	0.25	0.10	0.22	0.22	0.22	0.01
6	0.25	0.19	0.17	0.19	0.20	0.07
7	0.16	0.13	0.21	0.28	0.22	0.10
8	0.28	0.16	0.12	0.21	0.24	0.09
9	0.12	0.12	0.05	0.41	0.30	0.08
10	0.21	0.16	0.17	0.31	0.14	0.10
11	0.09	0.06	0.32	0.26	0.27	0.09
12	0.10	0.14	0.18	0.23	0.35	0.09
13	0.09	0.09	0.23	0.37	0.23	0.10
14	0.21	0.19	0.19	0.26	0.15	0.10
15	0.38	0.18	0.15	0.13	0.16	0.08
16	0.19	0.15	0.26	0.19	0.22	0.10
17	0.19	0.13	0.22	0.22	0.25	0.06
18	0.25	0.22	0.17	0.15	0.22	0.09
19	0.41	0.11	0.15	0.16	0.18	0.09
20	0.28	0.12	0.21	0.14	0.25	0.10
21	0.19	0.22	0.13	0.25	0.22	0.10
22	0.29	0.16	0.19	0.16	0.20	0.09

23	0.14	0.19	0.15	0.31	0.22	0.09
24	0.20	0.10	0.16	0.30	0.24	0.10
25	0.32	0.16	0.18	0.18	0.15	0.07
26	0.20	0.19	0.17	0.19	0.26	0.09
27	0.12	0.22	0.19	0.25	0.22	0.10
28	0.11	0.11	0.22	0.33	0.23	0.10
29	0.14	0.11	0.25	0.21	0.29	0.09
30	0.10	0.17	0.27	0.18	0.27	0.10
31	0.31	0.10	0.20	0.24	0.15	0.08
32	0.28	0.17	0.19	0.19	0.17	0.10
33	0.11	0.16	0.24	0.20	0.28	0.09
34	0.21	0.16	0.13	0.27	0.22	0.08
35	0.25	0.14	0.19	0.17	0.25	0.09
36	0.21	0.25	0.19	0.12	0.22	0.08
37	0.30	0.21	0.21	0.15	0.13	0.09
38	0.28	0.21	0.22	0.14	0.15	0.10
39	0.29	0.16	0.19	0.16	0.19	0.06
40	0.26	0.16	0.19	0.17	0.22	0.09
41	0.22	0.25	0.19	0.19	0.15	0.08
42	0.25	0.19	0.14	0.22	0.19	0.09
43	0.19	0.28	0.19	0.14	0.19	0.07
44	0.22	0.17	0.24	0.21	0.15	0.09
45	0.21	0.21	0.23	0.21	0.14	0.10
46	0.28	0.15	0.19	0.17	0.22	0.10
47	0.19	0.23	0.17	0.23	0.19	0.10
48	0.26	0.22	0.17	0.16	0.19	0.10
49	0.10	0.12	0.27	0.23	0.27	0.06
50	0.25	0.15	0.16	0.29	0.16	0.10
Weights	W_{81}	W_{82}	W_{83}	W_{84}	W_{85}	
Average	0.22	0.17	0.19	0.21	0.21	

Table B9 Logistics performance:

Person number	Location	Geographical distance	Packaging	Post-production configuration / ease of assembly	Hazardous goods management	CR
1	0.07	0.06	0.12	0.37	0.37	0.08
2	0.31	0.24	0.15	0.15	0.14	0.09
3	0.05	0.23	0.23	0.18	0.32	0.08
4	0.41	0.21	0.21	0.09	0.09	0.04
5	0.10	0.10	0.21	0.32	0.28	0.01
6	0.25	0.31	0.09	0.15	0.20	0.08
7	0.20	0.14	0.05	0.09	0.52	0.10
8	0.32	0.09	0.09	0.18	0.32	0.04
9	0.06	0.26	0.22	0.24	0.23	0.04
10	0.13	0.16	0.06	0.11	0.55	0.06
11	0.08	0.05	0.06	0.41	0.39	0.04
12	0.30	0.22	0.18	0.13	0.17	0.09
13	0.04	0.12	0.09	0.38	0.38	0.04
14	0.25	0.24	0.19	0.19	0.13	0.07
15	0.11	0.14	0.15	0.30	0.29	0.06
16	0.31	0.29	0.18	0.09	0.13	0.07
17	0.16	0.09	0.18	0.27	0.30	0.09
18	0.26	0.26	0.19	0.19	0.11	0.05
19	0.08	0.09	0.22	0.38	0.23	0.07
20	0.30	0.18	0.11	0.23	0.18	0.10
21	0.16	0.19	0.09	0.15	0.40	0.10
22	0.31	0.19	0.16	0.18	0.16	0.07
23	0.30	0.13	0.09	0.28	0.21	0.06
24	0.25	0.23	0.08	0.20	0.24	0.05
25	0.29	0.16	0.08	0.18	0.29	0.09
26	0.17	0.23	0.10	0.24	0.26	0.06
27	0.28	0.21	0.18	0.16	0.17	0.09
28	0.23	0.22	0.13	0.23	0.20	0.06
29	0.16	0.26	0.28	0.19	0.12	0.07
30	0.11	0.25	0.20	0.23	0.21	0.08
31	0.14	0.22	0.28	0.19	0.16	0.07
32	0.08	0.23	0.08	0.25	0.36	0.10
33	0.11	0.12	0.37	0.19	0.22	0.09
34	0.08	0.13	0.21	0.39	0.19	0.10
35	0.17	0.16	0.23	0.10	0.35	0.06
36	0.25	0.22	0.16	0.19	0.17	0.09

37	0.23	0.28	0.20	0.15	0.15	0.05
38	0.11	0.10	0.20	0.33	0.27	0.07
39	0.28	0.16	0.10	0.24	0.22	0.08
40	0.25	0.07	0.10	0.34	0.24	0.04
41	0.26	0.28	0.16	0.13	0.16	0.06
42	0.28	0.21	0.12	0.17	0.21	0.07
43	0.32	0.21	0.09	0.16	0.22	0.07
44	0.24	0.10	0.12	0.31	0.24	0.09
45	0.29	0.23	0.08	0.22	0.19	0.10
46	0.33	0.18	0.13	0.16	0.21	0.09
47	0.29	0.22	0.24	0.14	0.12	0.04
48	0.22	0.24	0.15	0.22	0.18	0.07
49	0.27	0.27	0.20	0.11	0.15	0.08
50	0.13	0.10	0.11	0.31	0.34	0.08
Weights	W_{91}	W_{92}	W_{93}	W_{94}	W_{95}	
Average	0.21	0.19	0.15	0.22	0.24	

Appendix C The analysis of separate UK and UAE results

- UK data analysis
    - UK main criteria

This section aims to discuss and analyse the different criteria affecting the choice of suppliers by UK buyers, i.e. it studies the influential factors (criteria) that affect the choice of suppliers by UK buyers. It shows the important criteria that are used by UK buyers for evaluating their suppliers. This section starts with the ANOVA table, model adequacy checks and finally the model graphs, including LSD plots.

- Analysis of Variance (ANOVA)

Analysing this factor revealed that the factor is significant, which indicates that at least one of the factor levels (criteria) significantly affects the choice of supplier more than the others. The resulting model is shown in the ANOVA table below (Table C1).

Table C1 ANOVA Table for the Evaluating Criteria (UK)

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	10.66	8	1.33	23.60	< 0.0001	significant
A-Evaluating Criteria	10.66	8	1.33	23.60	< 0.0001	
Pure Error	24.89	441	0.0564			
Cor Total	35.54	449				

As shown from the ANOVA, the model's p-value is extremely small (<0.0001) and thus it can be assumed to be significant, which indicates that at least one of the factor levels (criteria) is significantly different to the rest in the decision over the choice of suppliers made by UK buyers.

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions, as shown in Figures C1 and C2.

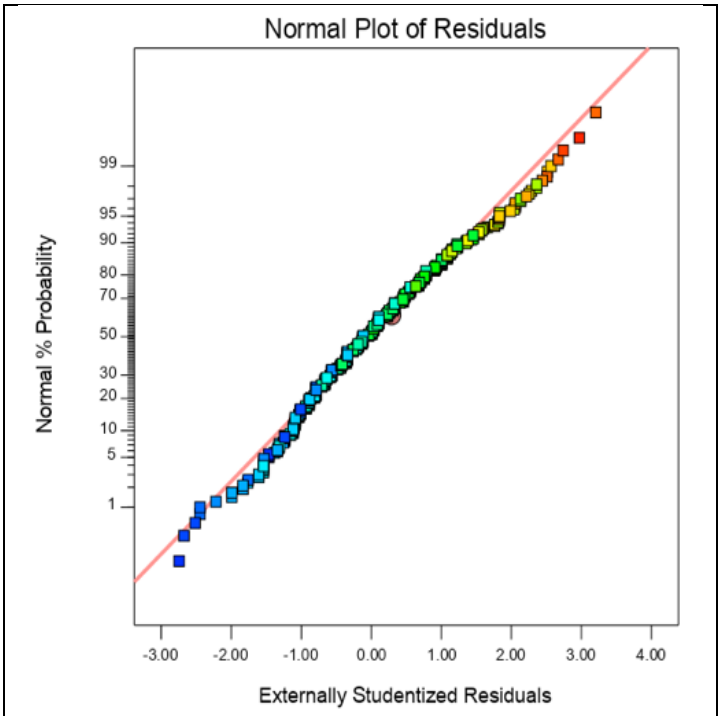


Figure C1 Normal Probability Plot

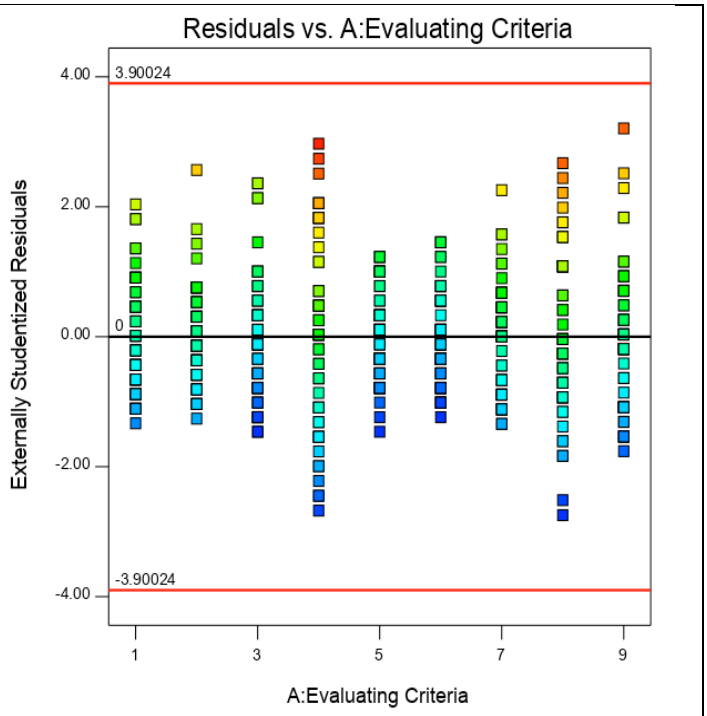


Figure C2 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C1, nearly all the plotted points can be represented approximately by a straight line. This means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria, shown in Figure C2, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C1, the model is significant at a significance level equal to less than 0.0001. It is worth saying that the original residual data required transformation into a power transformation function to be able to ensure that the data followed a normal distribution with constant variance.

- Model Graphs

Currently, we have reached the conclusion that not all the evaluating criteria equally affect the choice of suppliers by decision makers (buyers) in the UK. It is crucial now to indicate which criterion is significantly most important from the buyers' point of view. This can be revealed by the LSD plot shown in Figure C3 below.

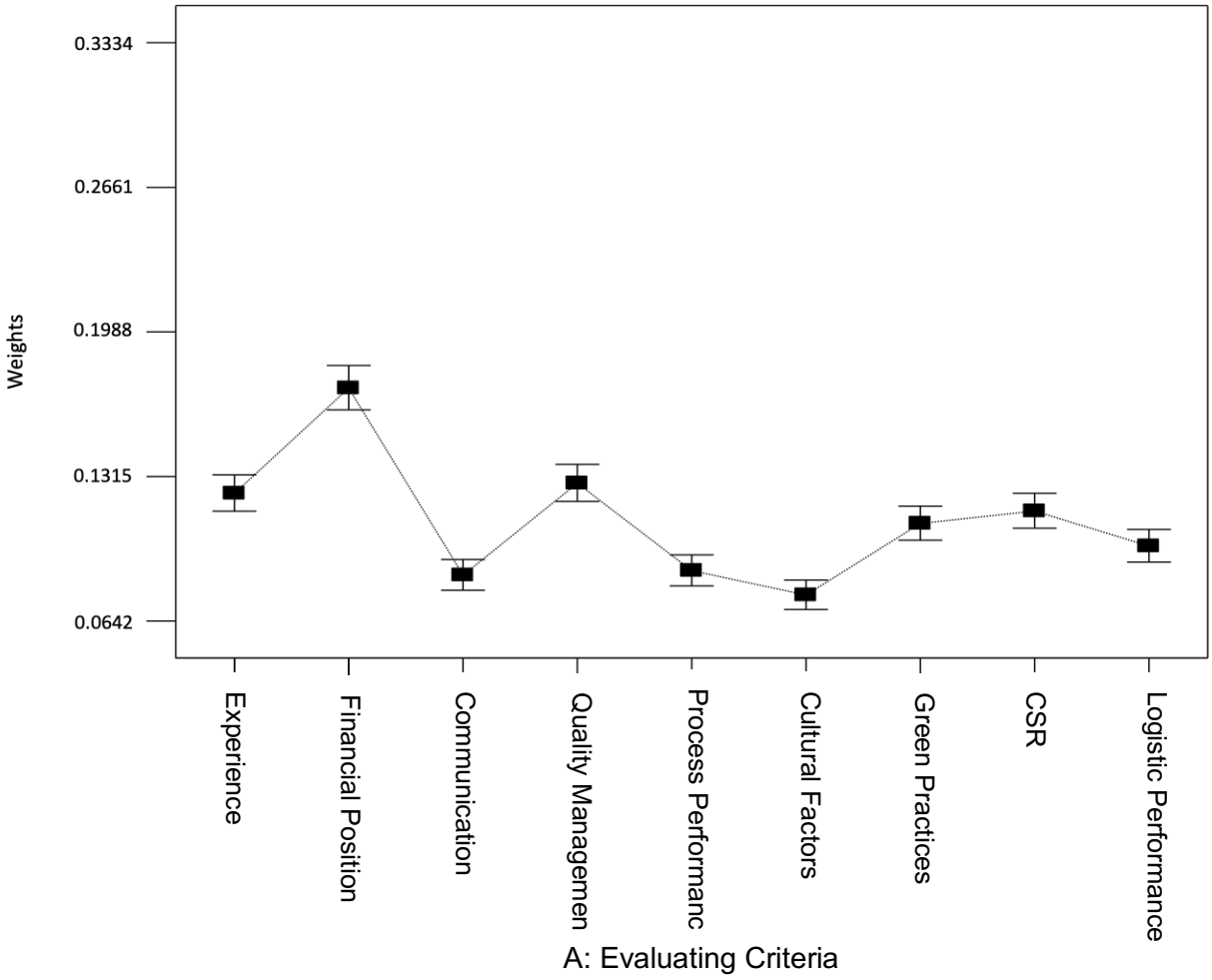


Figure C3 LSD Plot

The LSD plot shows that the most important criterion is the supplier financial position. Buyers from the UK care more about whether or not the supplier has a stable financial foundation than any other criterion. The next two criteria are almost equally important. Those are quality management and supplier experience. From the UK buyers' point of view, the rest of the six evaluating criteria – supplier corporate social responsibility (CSR), supplier green practices, supplier logistics performance, supplier communication and responsiveness, supplier process performance and supplier cultural factors – are significantly less important than the first three mentioned above. This highlights the fact that buyers from the UK care about factors relating to the supplier's financial position,

quality management and experience, and focus less on other factors, including cultural factors.

- UK sub-criteria

This section aims to discuss and analyse the results of the UK sub-criteria for the nine main criteria in the study framework. It defines the criteria in terms of the significant (important) sub-criteria, i.e. it studies the influential factors (sub-criteria) that affect the choice of suppliers by UK buyers. This will help suppliers to target those sub-criteria that matter the most to buyers in order to achieve acceptance. The section starts with the ANOVA table, to show if there is a difference between the result of evaluating each criterion in the UK, the model adequacy checks, and finally the model graphs, including LSD plots, to highlight the criteria that are the most or least important.

From the analysis of variance, all the criteria will be evaluated to decide whether any sub-criteria are more significant than others. The resulting model is shown in the ANOVA tables below (Tables C2 to C10) for each criterion available in the current research framework.

1. Supplier Experience

- ANOVA

As shown from the ANOVA (Table C2), the model's p-value is small (< 0.0001) and thus it can be assumed to be significant, which indicates that the importance of those sub-criteria under the supplier experience criterion varies significantly among UK decision makers in the decision over the choice of a supplier.

Table C2 ANOVA Table for Supplier Experience

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	4.64	5	0.9274	16.35	< 0.0001	significant
A-Supplier Experience	4.64	5	0.9274	16.35	< 0.0001	
Pure Error	16.67	294	0.0567			
Cor Total	21.31	299				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions as shown in Figures C4 and C5.

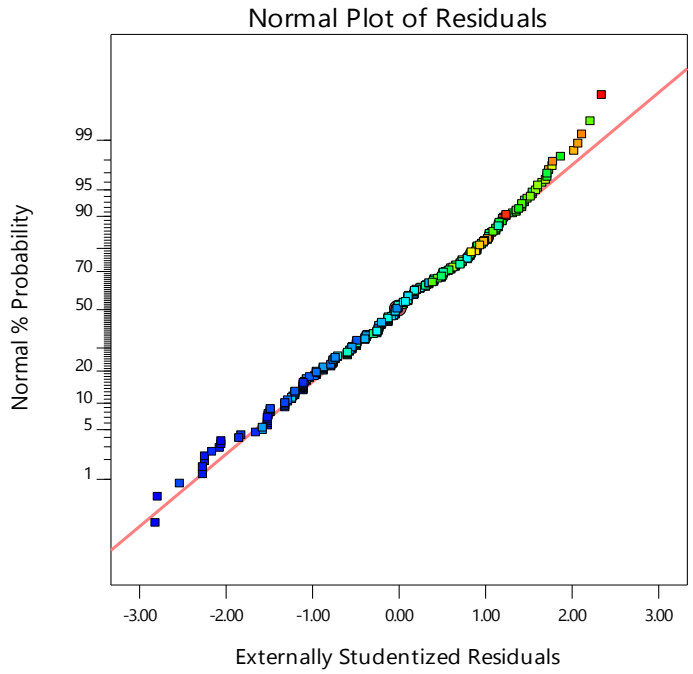


Figure C4 Normal Probability Plot

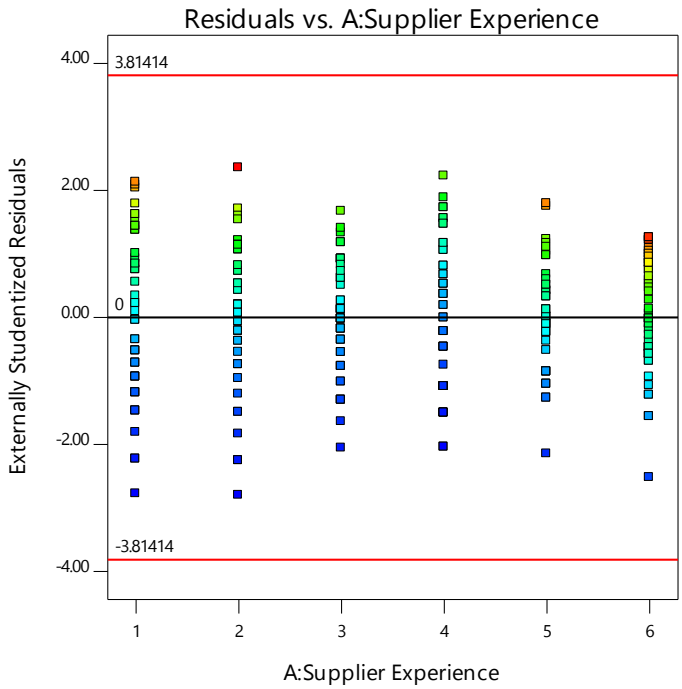


Figure C5 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C4, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria, shown in Figure C5, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C2, the model is significant at a significance level of less than 0.0001.

- Model Graphs

Currently, we have reached the conclusion that the sub-criteria under the supplier experience criterion are not equally evaluated by decision makers (buyers) from the UK

when choosing suppliers. It is crucial now to indicate which sub-criterion is significantly more preferred from the UK buyers' point of view. This can be revealed from the LSD plot shown in Figure C6 below.

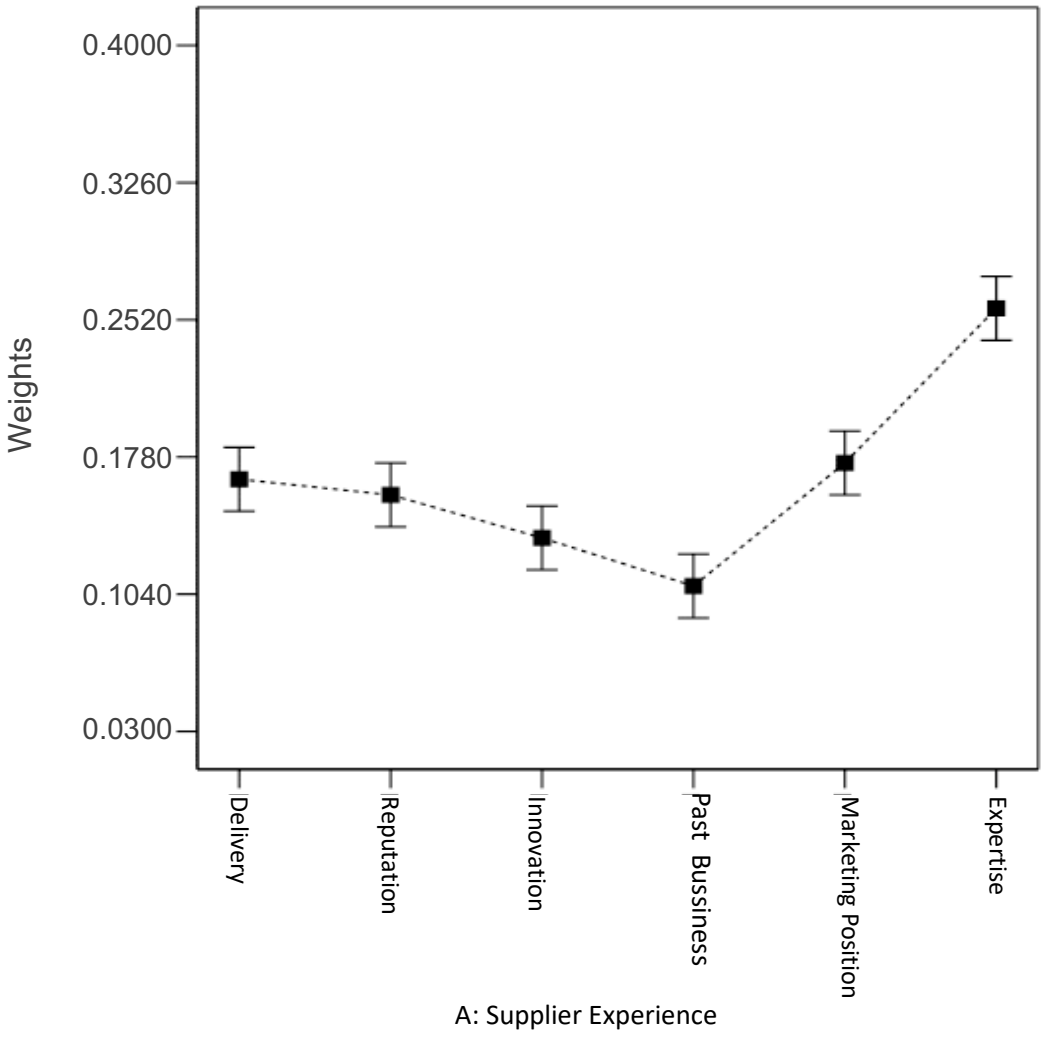


Figure C6 LSD Plot

The LSD plot shows that the supplier expertise sub-criterion is the most important for UK decision makers in supplier selection, followed by the marketing position sub-criterion. The rest of the sub-criteria are less important, with amount of past business being the least important.

2. Supplier Financial Position

- ANOVA

As shown from the ANOVA (Table C3), the model's p-value is small (< 0.0001) and thus it can be assumed to be significant, which indicates that the importance of those sub-criteria under the supplier financial position criterion varies significantly among UK decision makers in the decision over the choice of a supplier.

Table C3 ANOVA Table for Supplier Financial Experience

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	13.35	4	3.34	133.71	< 0.0001	significant
A-Financial Position	13.35	4	3.34	133.71	< 0.0001	
Pure Error	6.11	245	0.0250			
Cor Total	19.46	249				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions, as shown in Figures C7 and C8.

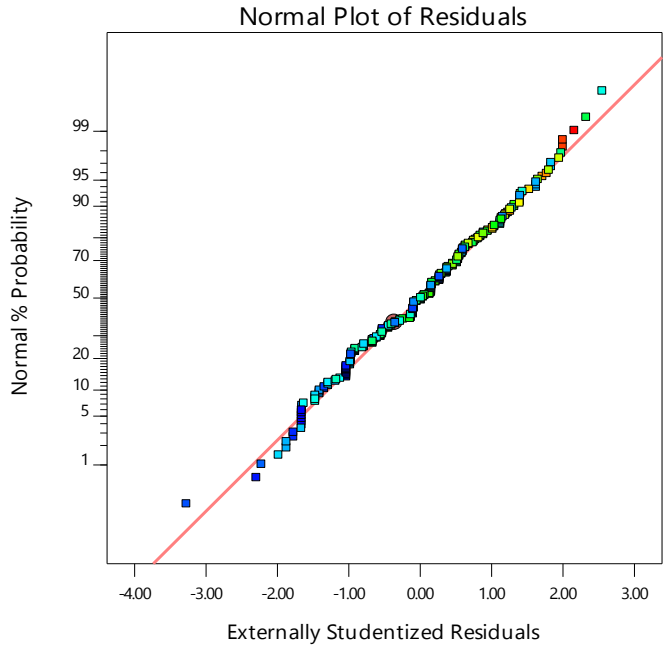


Figure C7 Normal Probability Plot

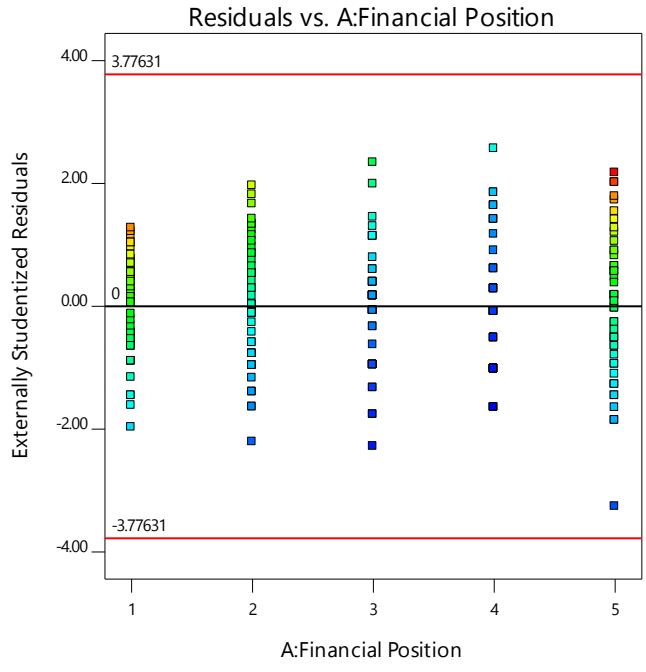


Figure C8 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C7, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria, Figure C8, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C3, the model is significant at a significance level equal to less than 0.0001.

- Model Graphs

Currently, we have reached the conclusion that all the sub-criteria under the supplier financial position criterion are not equally evaluated by decision makers (buyers) from the UK when choosing a supplier. It is crucial now to indicate which sub-criterion is significantly more preferred from the UK buyers' point of view. This can be revealed from the LSD plot shown in Figure C9 below.

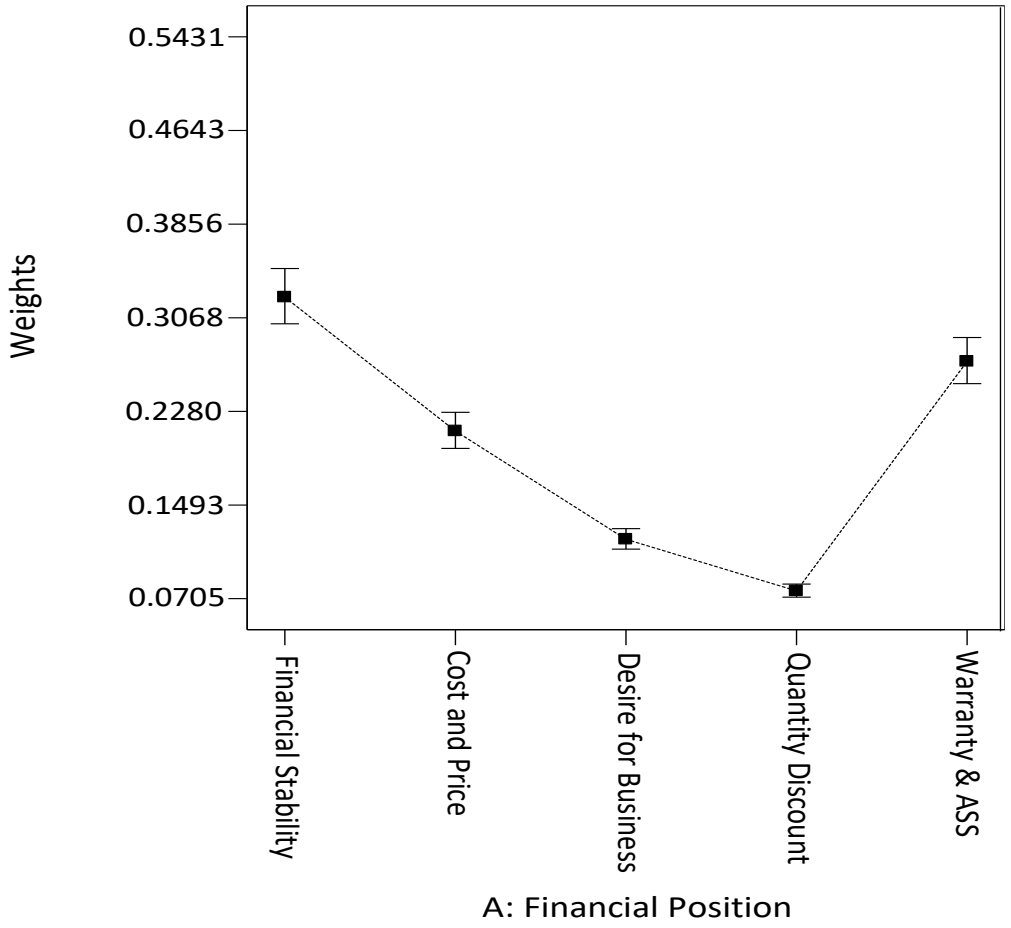


Figure C9 LSD Plot

The LSD plot shows that the financial stability sub-criterion is the most important for UK decision makers in supplier selection, followed by the warranty and aftersales service sub-criterion. The third most important sub-criterion is cost and price, followed by desire for business and finally the least important sub-criterion is quantity discount from the UK buyers' point of view.

3. **Communication and Responsiveness**

- ANOVA

As shown from the ANOVA (Table C4), the model's p-value is small (< 0.0001) and thus it can be assumed to be significant, which indicates that the importance of those sub-

criteria under the supplier communication and responsiveness criterion varies significantly among UK decision makers in the decision over the choice of a supplier.

Table C4 ANOVA Table for Communication and Responsiveness

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.1273	4	0.0318	13.30	< 0.0001	significant
A-Communication and Responsiveness	0.1273	4	0.0318	13.30	< 0.0001	
Pure Error	0.5861	245	0.0024			
Cor Total	0.7133	249				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions as shown in Figures C10 and C11.

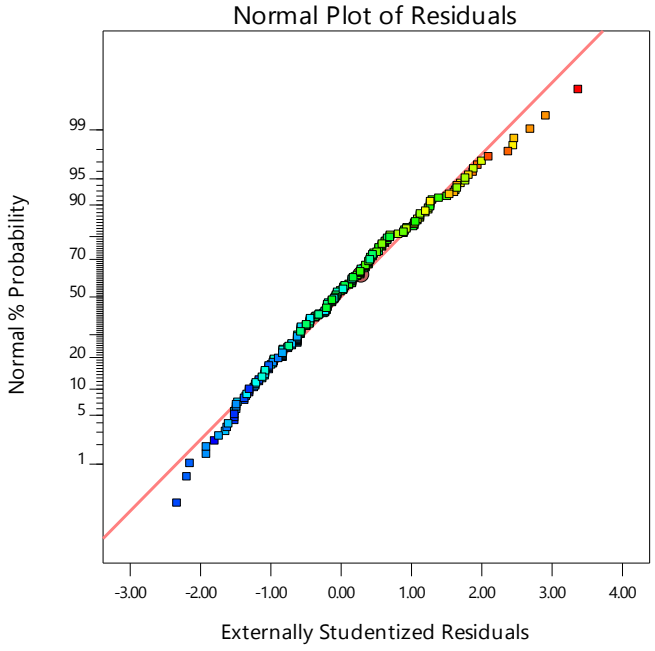


Figure C10 Normal Probability Plot

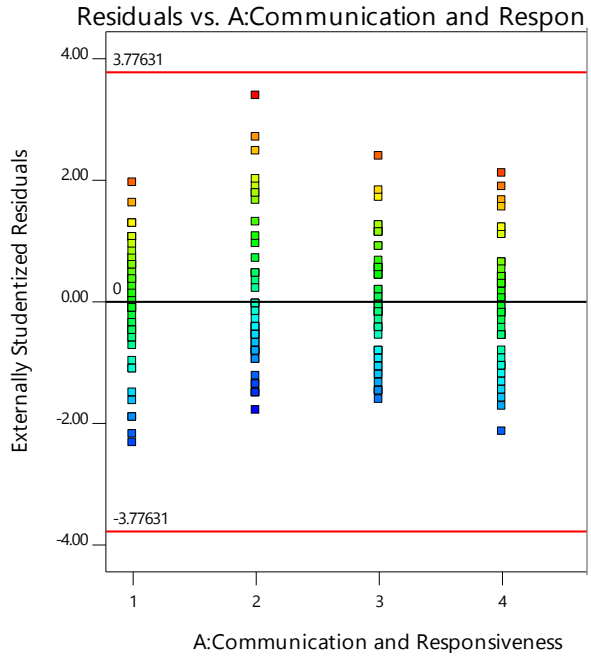


Figure C11 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C10, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately

normal distribution. The plot of the residual versus its evaluating criteria, Figure C11, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C4, the model is significant at a significance level equal to less than 0.0001.

- Model Graphs

Currently, we have reached the conclusion that the sub-criteria under the communication and responsiveness criterion are not equally evaluated by decision makers (buyers) from the UK when choosing a supplier. It is crucial now to indicate which sub-criterion is significantly more preferred from the UK buyers' point of view. This can be revealed from the LSD plot shown in Figure C12 below.

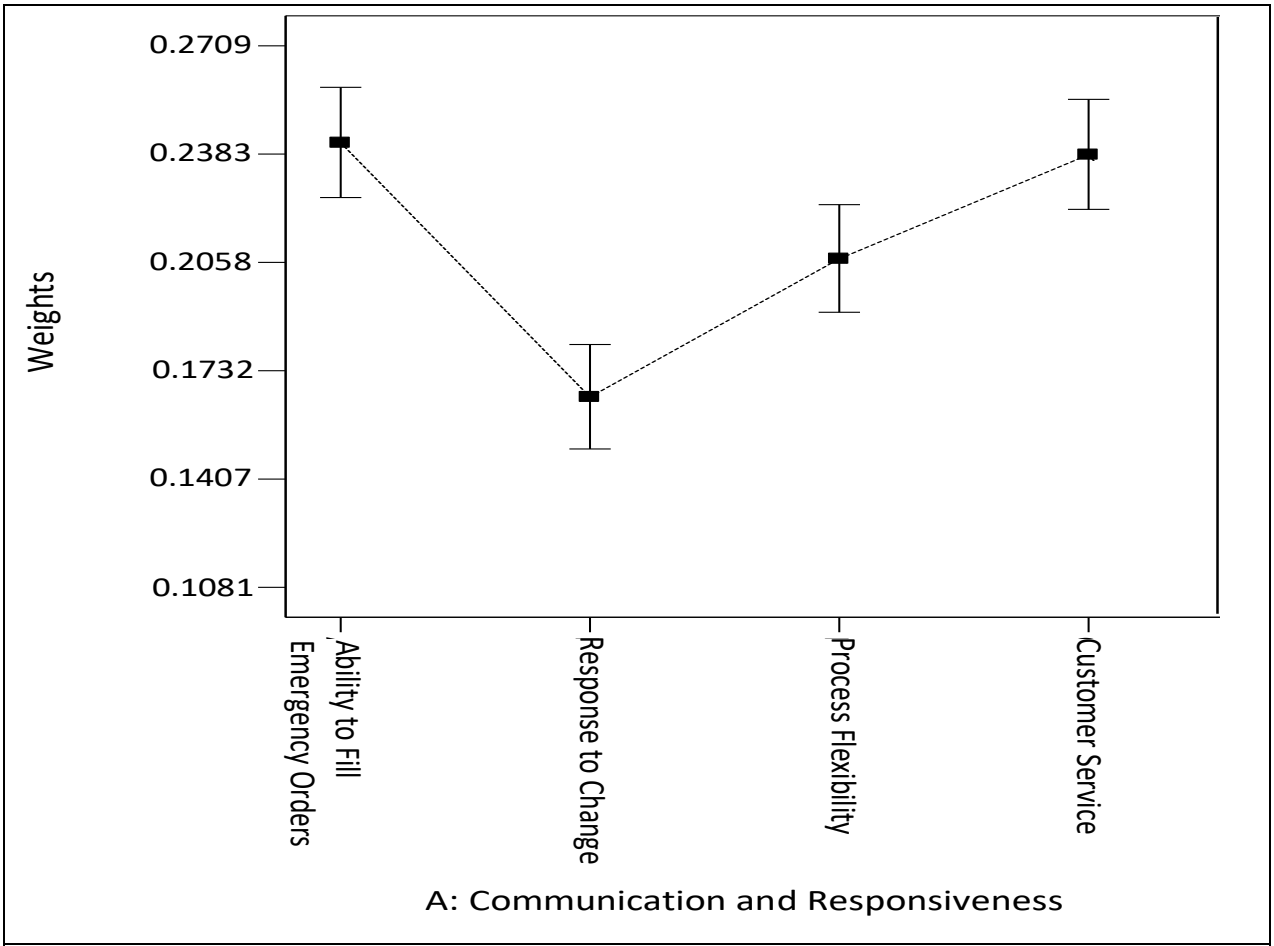


Figure C12 LSD Plot

The LSD plot shows that ability to fill emergency orders, customer service and process flexibility are the most important sub-criteria for UK buyers in the supplier selection decision.

4. Quality Management

- ANOVA

As shown from the ANOVA (Table C5), the model's p-value is small (< 0.0001) and thus it can be assumed to be significant, which indicates that the importance of those sub-criteria under the quality management criterion varies significantly among UK decision makers in the decision over the choice of a supplier.

Table C5 ANOVA Table for Quality Management

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	33.33	5	6.67	31.00	< 0.0001	significant
A-Quality Management	33.33	5	6.67	31.00	< 0.0001	
Pure Error	63.22	294	0.2150			
Cor Total	96.55	299				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions as shown in Figures C13 and C14.

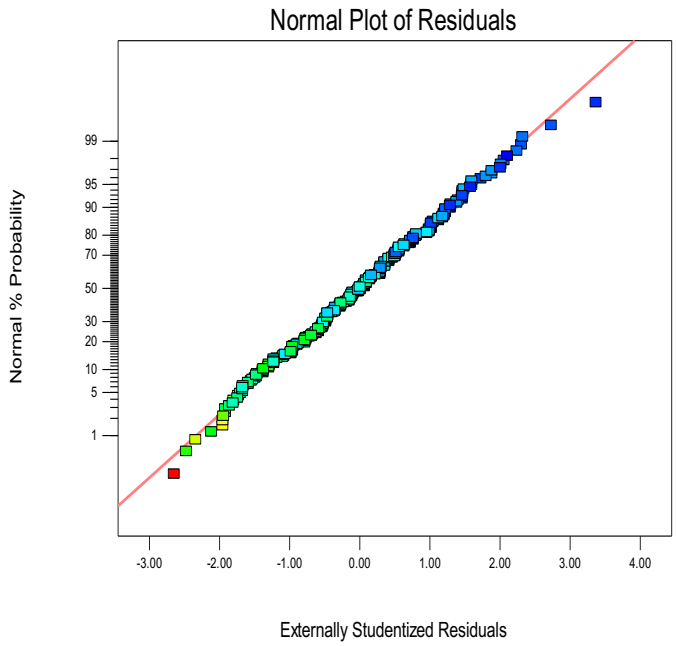


Figure C13 Normal Probability Plot

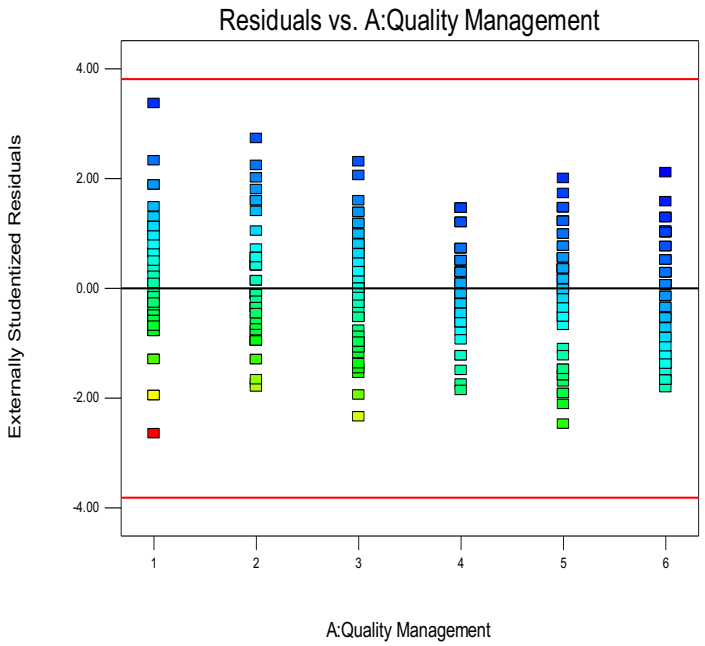


Figure C14 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C13, nearly all the plotted points can be represented by a straight line. This means that the residuals plot follows an approximately normal distribution. The plot of the residual versus its evaluating criteria, Figure C14, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C5, the model is significant at a significance level of less than 0.0001.

- Model Graphs

Currently, we reached the conclusion that the sub-criteria under the supplier quality management criterion are not equally evaluated by decision makers (buyers) from the UK when choosing a supplier. It is crucial now to indicate which sub-criterion is significantly more preferred from the UK buyers' point of view. This can be revealed from the LSD plot shown in Figure C15 below.

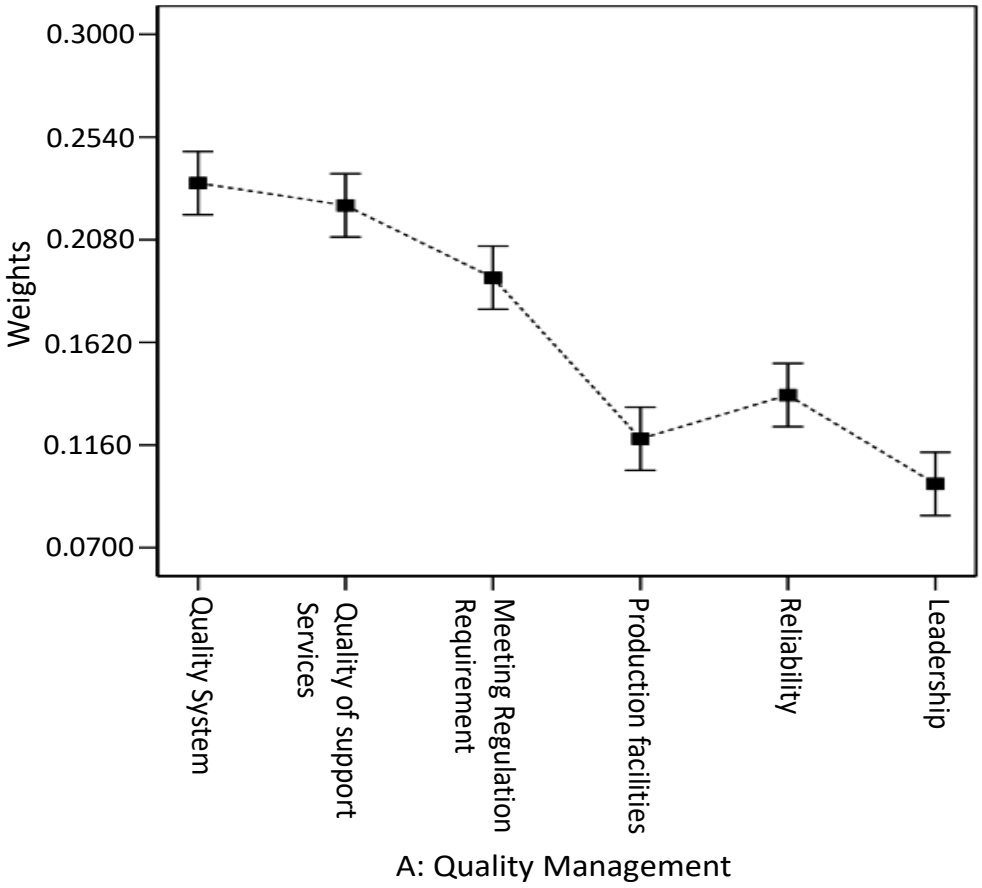


Figure C15 LSD Plot

The LSD plot shows that quality system, quality of support services and meeting regulatory requirements are the most important sub-criteria for UK decision makers in supplier selection. The other three sub-criteria (reliability, production facilities and capabilities and organisational leadership) are less important.

5. Process Performance

- ANOVA

As shown from the ANOVA (Table C6), the model's p-value is small (<0.0001) and thus it can be assumed to be significant, which indicates that the importance of those sub-criteria under the process performance criterion varies significantly among UK decision makers in the decision over the choice of a supplier.

Table C6 ANOVA Table for Process Performance

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.1287	4	0.0322	16.62	< 0.0001	significant
A-Process Performance	0.1287	4	0.0322	16.62	< 0.0001	
Pure Error	0.4744	245	0.0019			
Cor Total	0.6031	249				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions as shown in Figures C16 and C17.

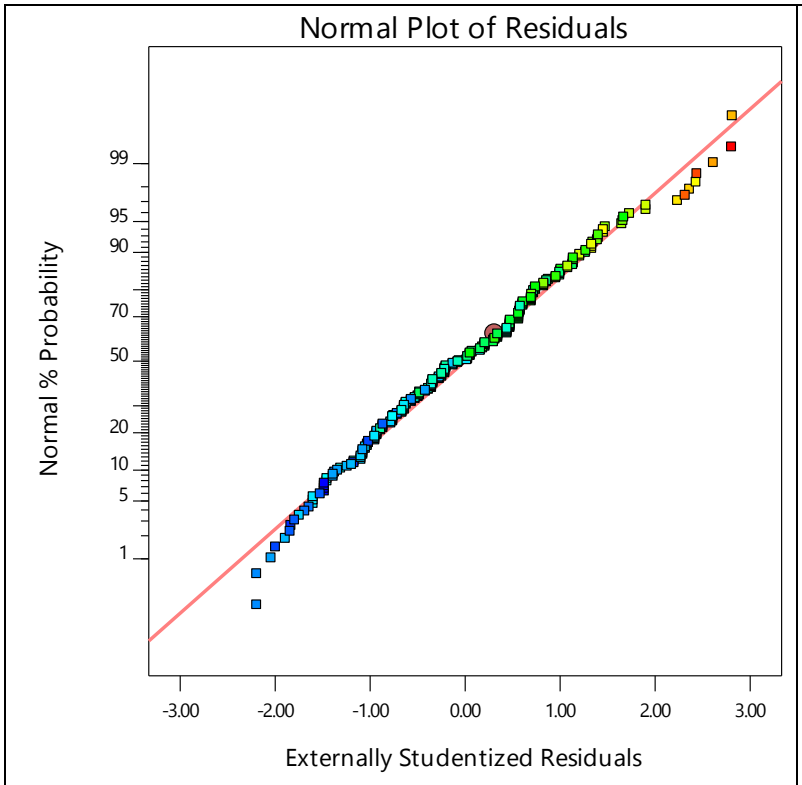


Figure C16 Normal Probability Plot

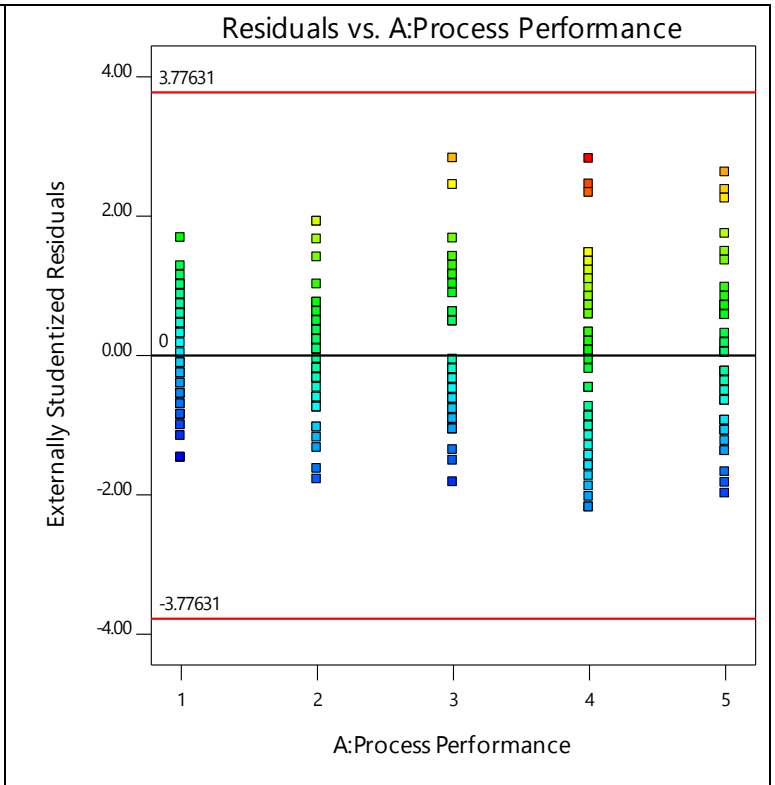


Figure C17 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C16, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately

normal distribution. The plot of the residual versus its evaluating criteria, shown in Figure C17, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C6, the model is significant at a significance level of less than 0.0001.

- Model Graphs

Currently, we have reached the conclusion that the sub-criteria under the process performance criterion are not equally evaluated by decision makers (buyers) from the UK when choosing a supplier. It is crucial now to indicate which sub-criterion is significantly more preferred from the UK buyers' point of view. This can be revealed from the LSD plot shown in Figure C18 below. This conclusion matches the output of the ANOVA shown in Table C6 above.

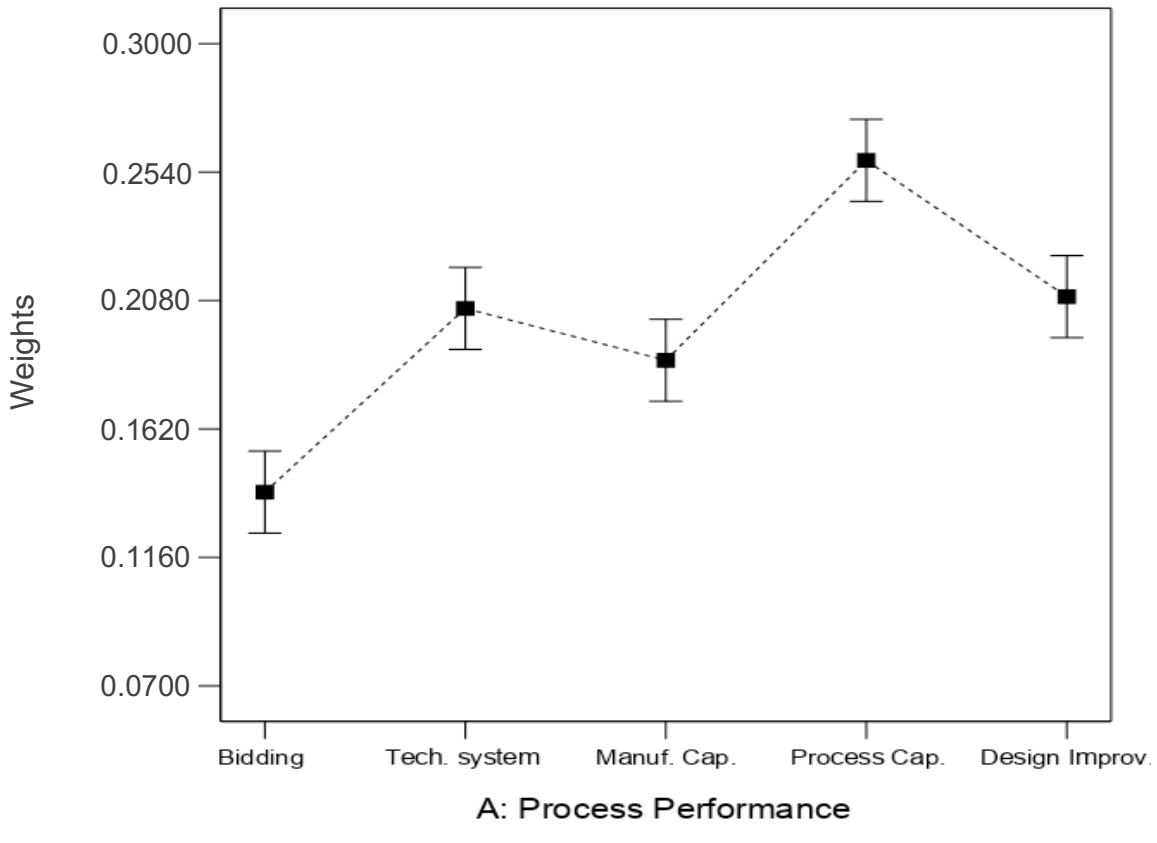


Figure C18 LSD Plot

The LSD plot shows that the process capability criterion is the most important for UK decision makers in supplier selection. The three sub-criteria design/process improvement, technological system and technical support and future manufacturing capability are equally evaluated but less important than the process capability sub-criterion. The least important sub-criterion is bidding procedure.

6. Cultural Factors

- ANOVA

As shown from the ANOVA (Table C7), the model's p-value is 0.1323, which is greater than 0.05. This indicates that the model terms are not significant, which means that this factor (sub-criteria), supplier cultural factors, was not valued significantly differently by UK buyers for the decision over the choice of suppliers. Approximately all the UK buyers valued these sub-criteria equally.

Table C7 ANOVA Table for Cultural Factors

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.2564	2	0.1282	2.05	0.1323	not significant
A-Cultural Factors	0.2564	2	0.1282	2.05	0.1323	
Pure Error	9.19	147	0.0625			
Cor Total	9.45	149				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions as shown in Figures C19 and C20.

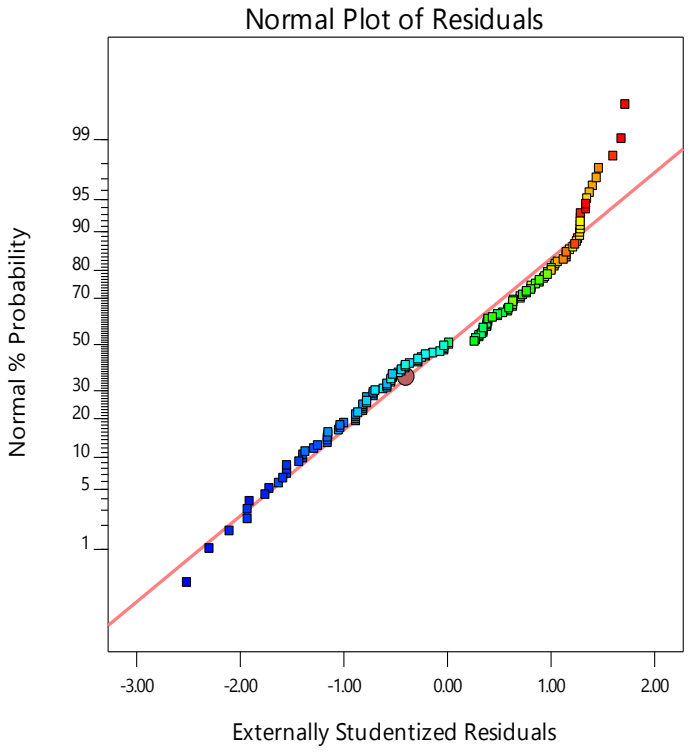


Figure C19 Normal Probability Plot

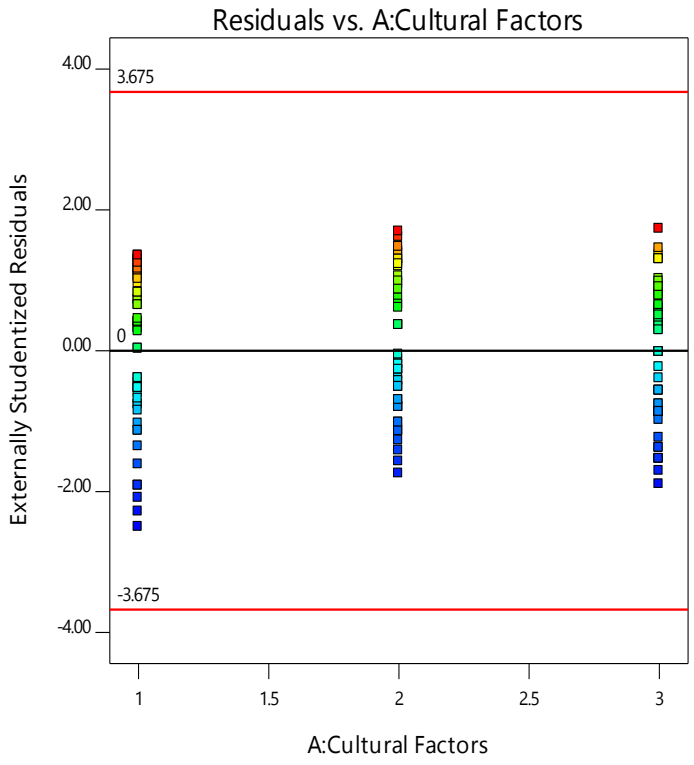


Figure C20 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C19, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria, Figure C20, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C7, the model is not significant at a significance level equal to 0.1323.

- Model Graphs

Currently, we have reached the conclusion that the sub-criteria under the cultural factors criterion are equally evaluated by decision makers (buyers) from the UK when choosing suppliers. The LSD plot in Figure C21 below shows that there is an overlap between the three sub-criteria's evaluation results, which means there is no difference in the

importance of these criteria in the supplier selection decision. This conclusion matches the output of the ANOVA shown in Table C7 above.

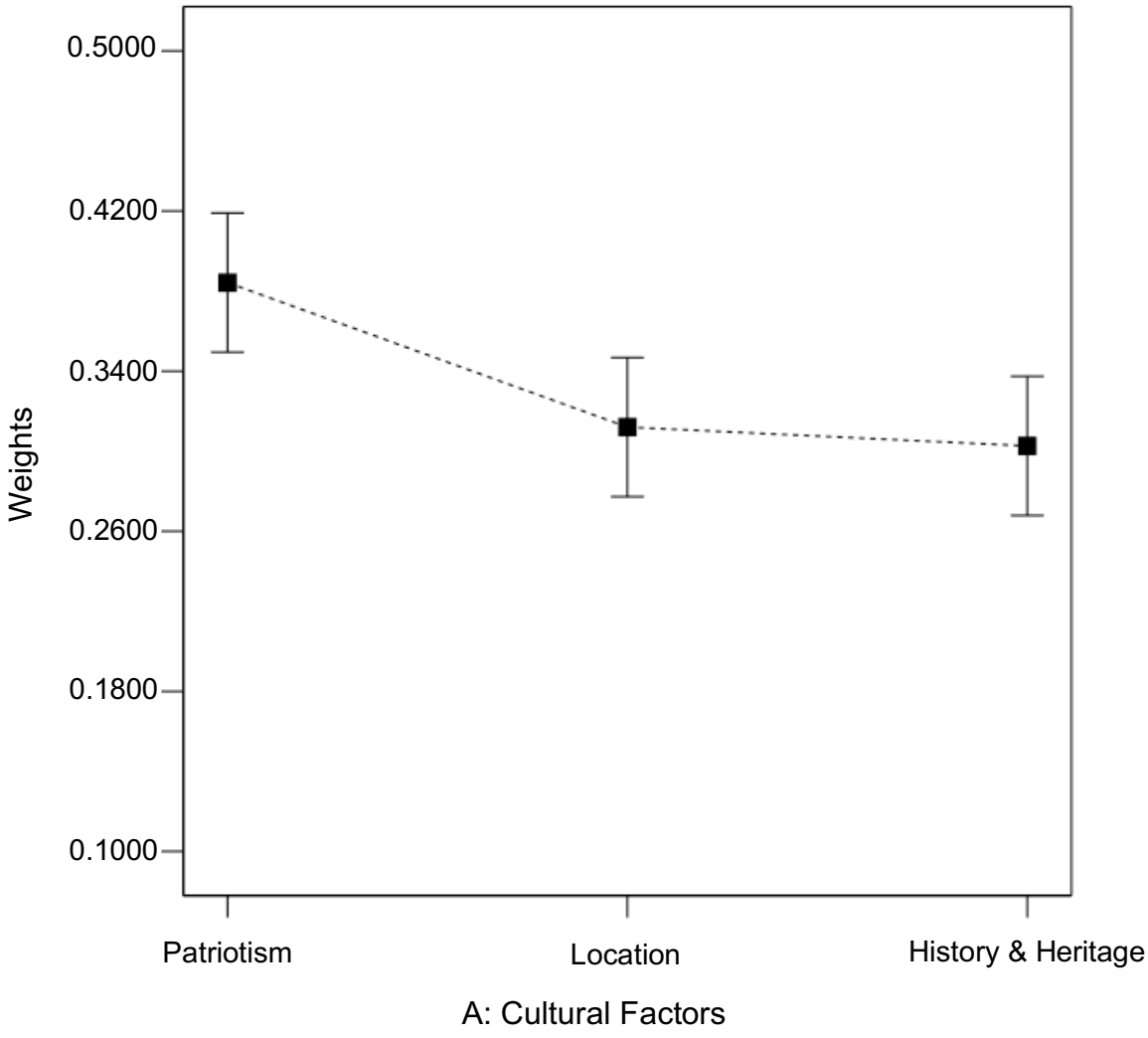


Figure C21 LSD Plot

The LSD plot shows that all the sub-criteria under the cultural factors criterion are approximately equally important from the UK decision makers' point of view, with patriotism for same culture and beliefs being the most important.

7. Green Practices

- ANOVA

As shown from the ANOVA (Table C8), the model's p-value is 0.7760, which is greater than 0.05. This indicates that the model terms are not significant, which means that this factor (sub-criteria), supplier green practices, was not valued significantly differently by UK buyers for the decision over the choice of suppliers. Approximately all the UK buyers valued these sub-criteria equally.

Table C8 ANOVA Table for Green Practices

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0224	3	0.0075	0.3682	0.7760	not significant
A-Green Practices	0.0224	3	0.0075	0.3682	0.7760	
Pure Error	3.98	196	0.0203			
Cor Total	4.00	199				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions as shown in Figures C22 and C23.

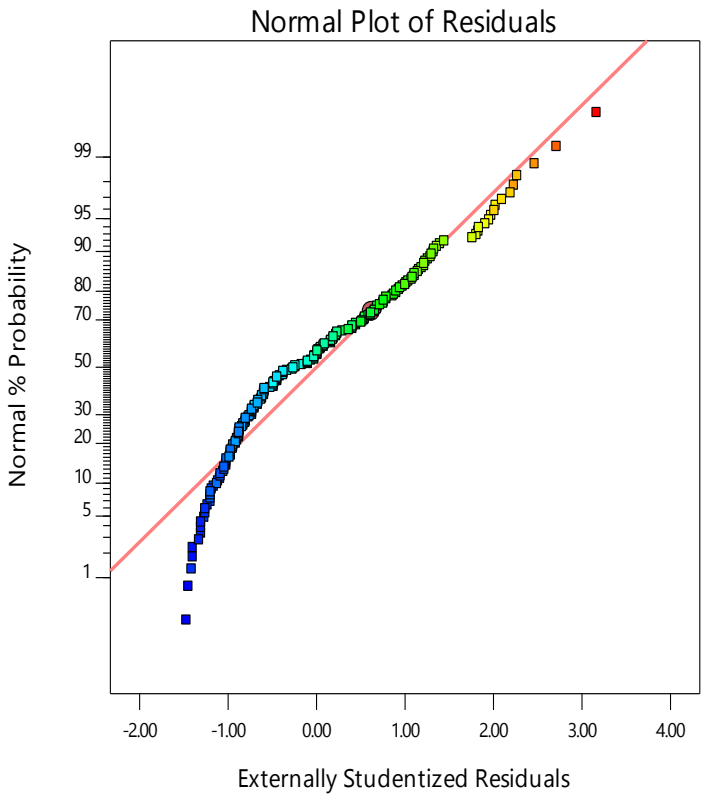


Figure C22 Normal Probability Plot

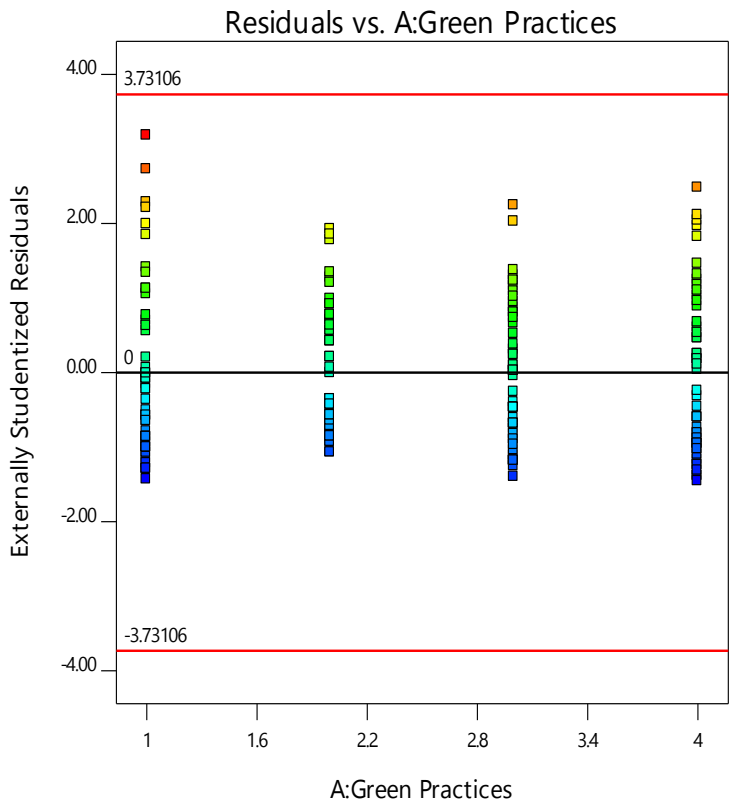


Figure C23 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C22, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria, shown in Figure C23, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C8, the model is not significant at a significance level equal to 0.7760.

- Model Graphs

Currently, we have reached the conclusion that the sub-criteria under the green practices criterion are equally evaluated by decision makers (buyers) from the UK in supplier selection. The LSD plot in Figure C24 below shows that there is an overlap between all

the sub-criteria evaluation results, which means there is no difference in the importance of these sub-criteria in the supplier selection decision. This conclusion matches the output of the ANOVA shown in Table C8 above.

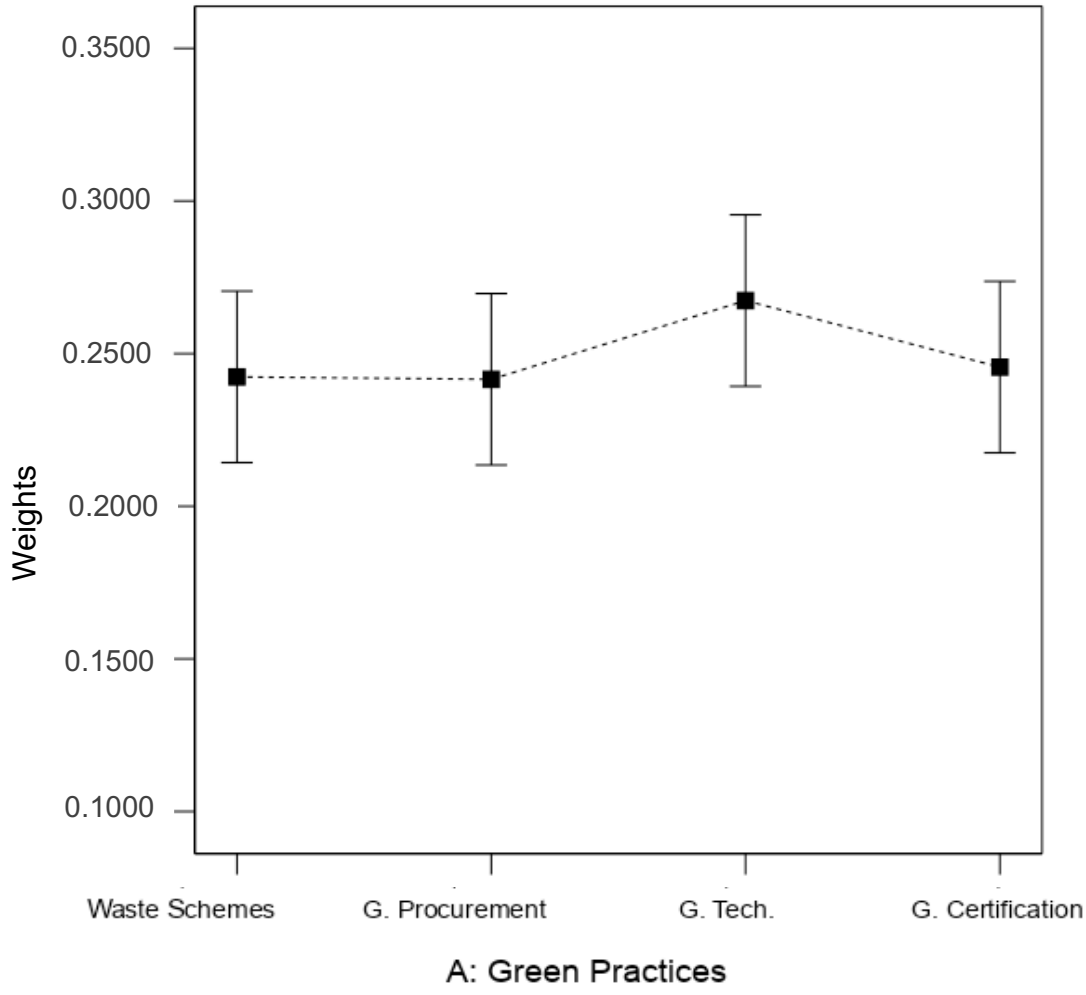


Figure C24 LSD Plot

The LSD plot shows that all the sub-criteria under the green practice criterion are equally important from the UK buyers (decision makers) point of view, with more attention given to green technology and operation.

8. CSR

- ANOVA

As shown from the ANOVA (Table C9), the model's p-value is small (<0.0001) and thus it can be assumed to be significant, which indicates that the importance of those sub-criteria under the CSR criterion varies significantly between UK decision makers in the decision over the choice of supplier.

Table C9 ANOVA Table for CSR

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.5814	4	0.1453	38.51	< 0.0001	significant
A-CSR	0.5814	4	0.1453	38.51	< 0.0001	
Pure Error	0.9246	245	0.0038			
Cor Total	1.51	249				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions as shown in Figures C25 and C26.

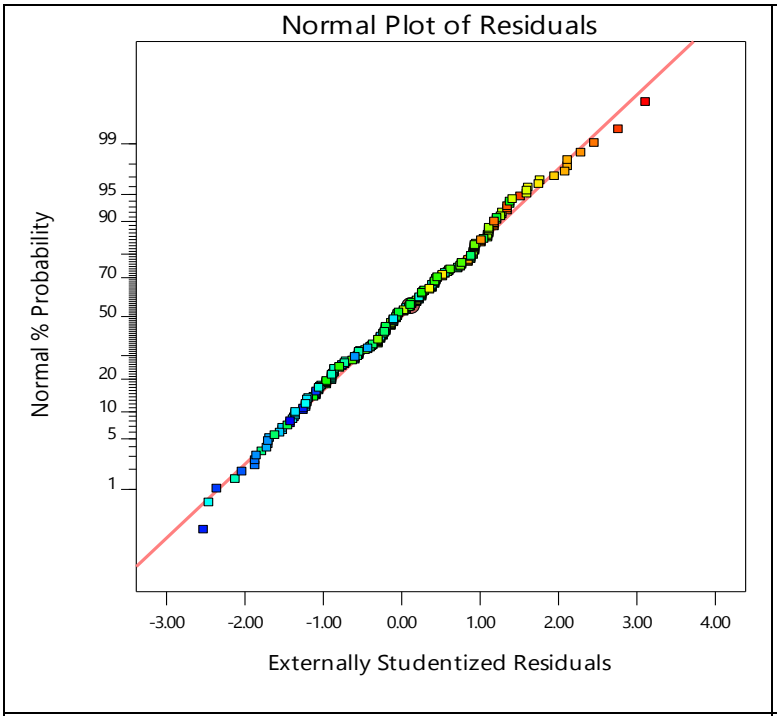


Figure 25 Normal Probability Plot

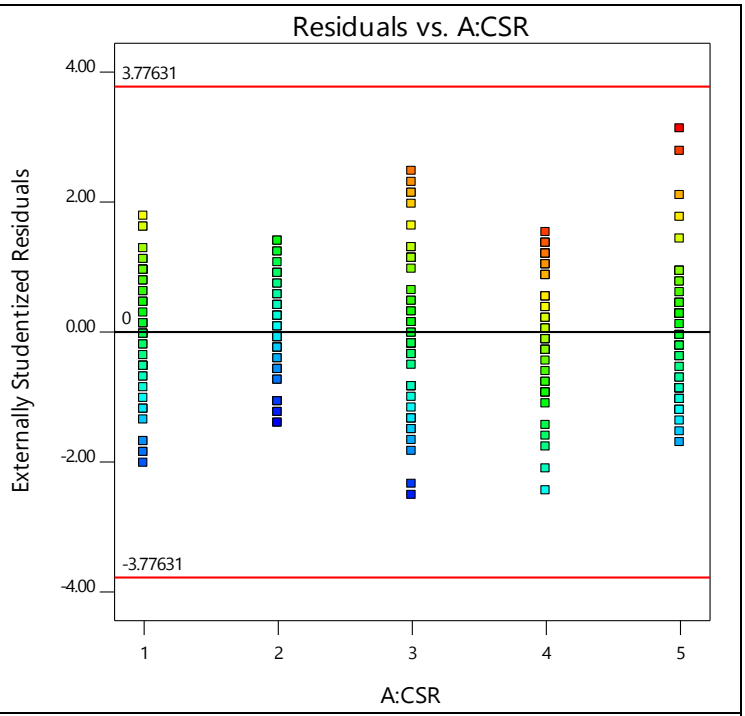


Figure 26 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C25, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria, Figure C26, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C9, the model is significant at a significance level less than 0.0001.

- Model Graphs

Currently, we have reached the conclusion that the sub-criteria under the CSR criterion are not equally evaluated by decision makers (buyers) from the UK when choosing a supplier. It is crucial now to indicate which sub-criterion is significantly more preferred from the UK buyers' (decision makers') point of view. This can be revealed from the LSD plot shown in Figure C27 below.

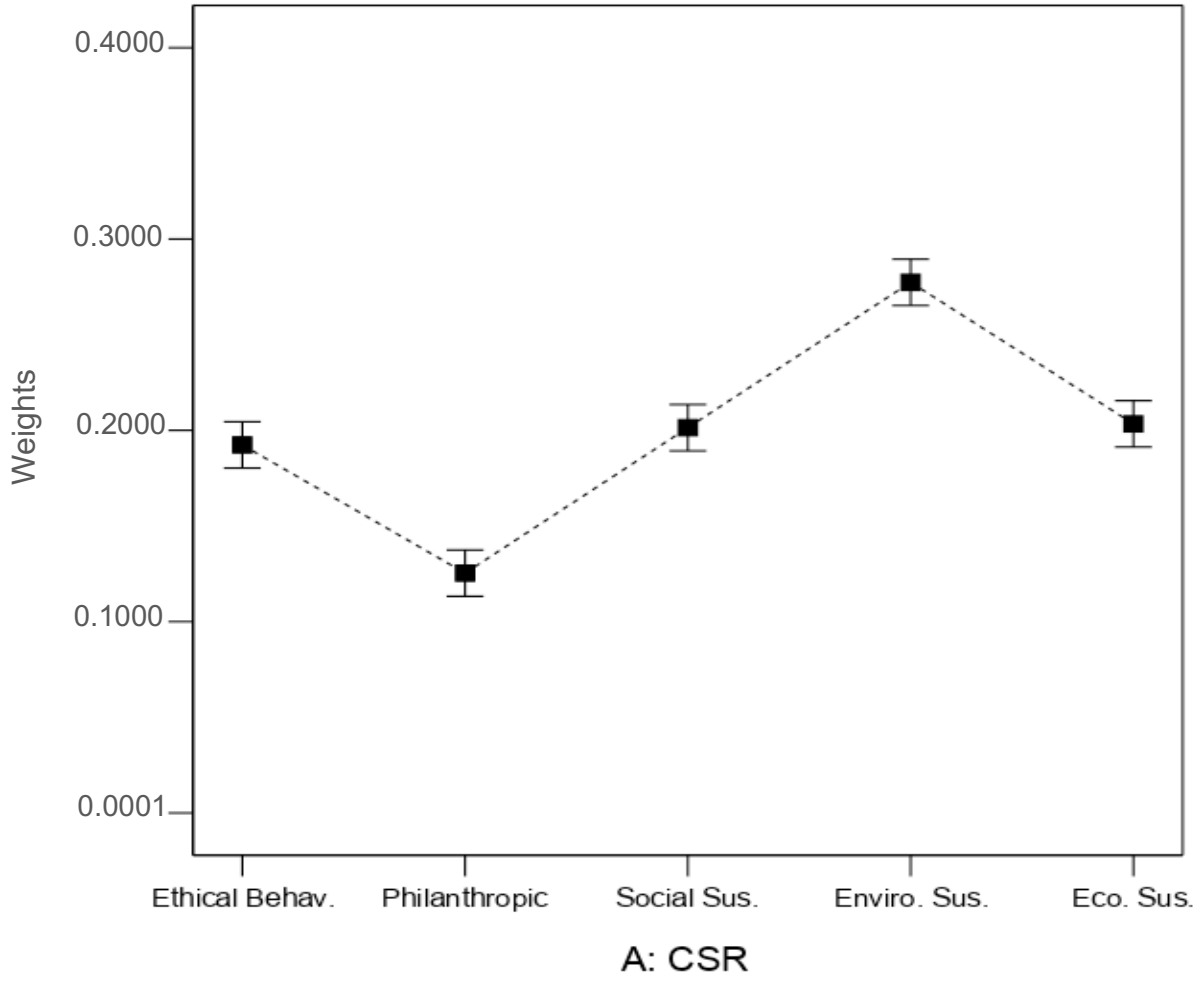


Figure C27 LSD Plot

The LSD plot shows that the environmental sustainability criterion is the most important for UK decision makers in supplier selection. Following this criterion, three other sub-criteria (economic sustainability, social sustainability and ethical behaviour) are equally important. The least important sub-criterion is philanthropic responsibility.

9. Supplier Logistics Performance

- ANOVA

As shown from the ANOVA Table C10, the model's p-value is small (< 0.0001) and thus it can be assumed to be significant, which indicates that the importance of those sub-

criteria under the supplier logistics performance criterion varies significantly among UK decision makers in the decision over the choice of a supplier.

Table C10 ANOVA Table for Supplier Logistics Performance

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	1.11	4	0.2773	12.50	< 0.0001	significant
A-Logistics Performance	1.11	4	0.2773	12.50	< 0.0001	
Pure Error	5.43	245	0.0222			
Cor Total	6.54	249				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions as shown in Figures C28 and C29. It is worth saying that the model required transformation into square root in order for the residuals to follow an approximately normal distribution with constant variance.

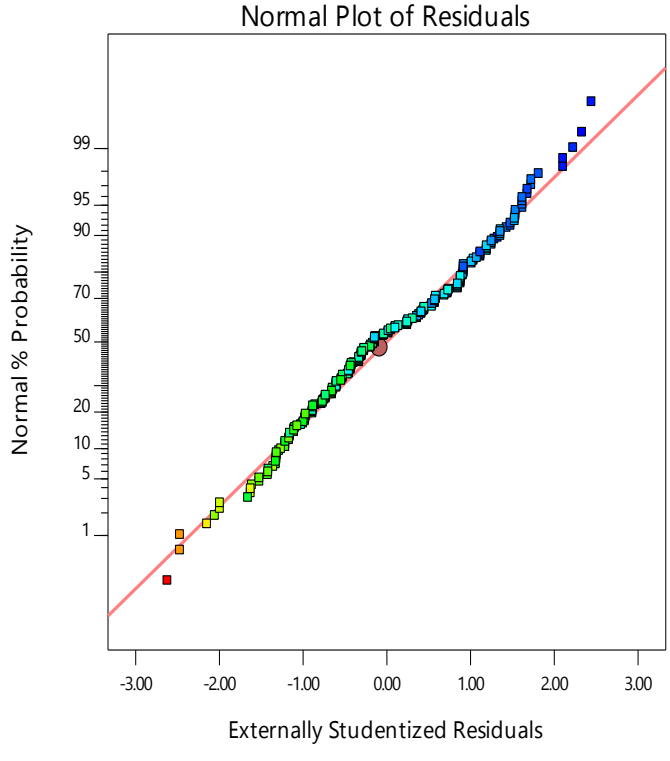


Figure C28 Normal Probability Plot

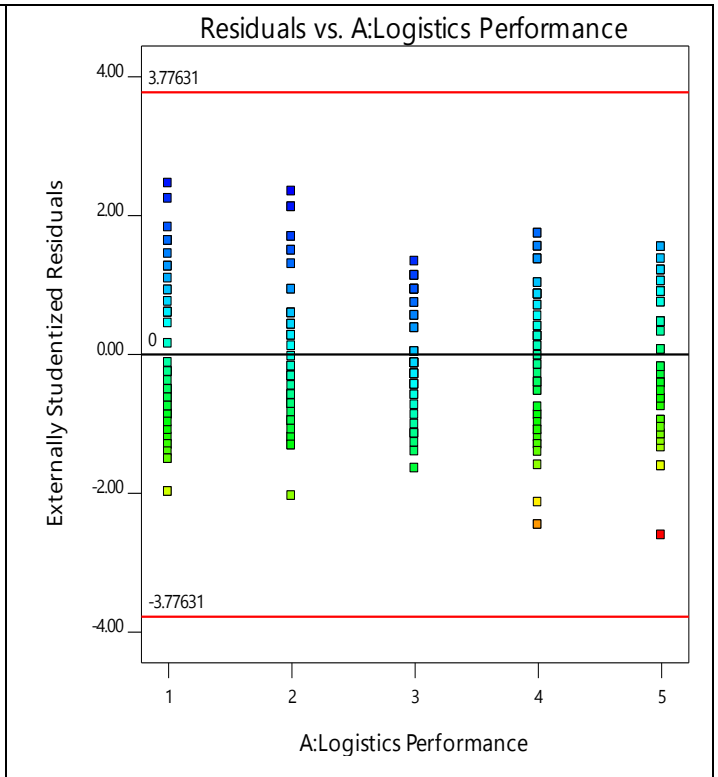


Figure C29 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C28, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria, shown in Figure C29, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination for the residual revealed no violations of the ANOVA underlying assumptions, which mean that the ANOVA results can be trusted. Therefore, as indicated in Table C10, the model is significant at a significance level of less than 0.0001.

- Model Graphs

Currently, we have reached the conclusion that all the sub-criteria under the supplier logistic performance criterion are not equally evaluated by decision makers (buyers) from the UK when choosing suppliers. It is crucial now to indicate which sub-criterion is significantly more preferred from the UK buyers' (decision makers') point of view. This can be revealed from the LSD plot shown in Figure 30 below.

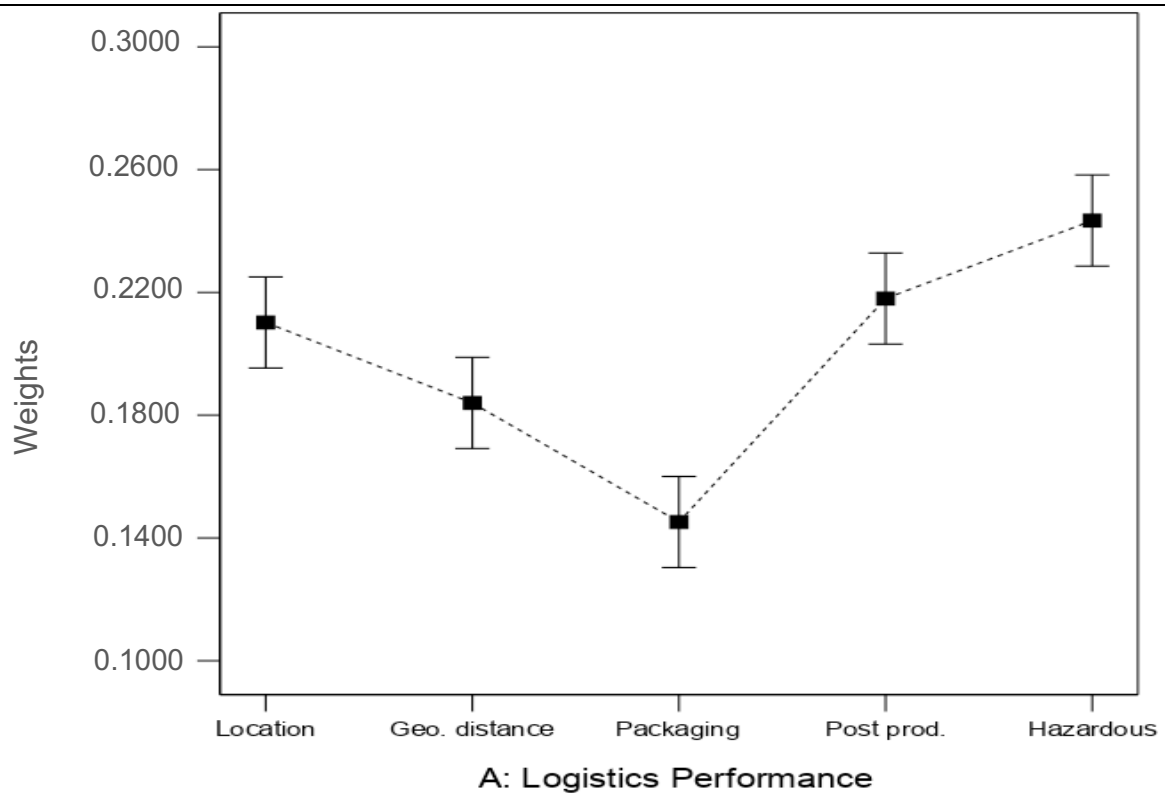


Figure C30 LSD Plot

The LSD plot shows that the hazardous goods management and post-production configuration sub-criteria are the most important for UK decision makers in supplier selection, followed by the location and geographical distance sub-criteria. The least important sub-criterion is packaging.

- **UAE Data Analysis:**
    - UAE main Criteria

This section aims to discuss and analyse the results of the UAE for the nine main criteria in the study framework. It defines the criteria in terms of their significance (importance), i.e. it studies the influential factors that affect the choice of suppliers by UAE buyers. This will help suppliers to target the criteria that matter the most to buyers in order to achieve acceptance. The section starts with the ANOVA table, to show if there is a difference between the result of evaluating each criterion in the UAE, the model adequacy check and finally the model graphs (mainly LSD plots) to highlight the criteria that are the most or least important.

- Analysis of Variance (ANOVA)

Analysing this factor revealed that it is significant. This indicates that at least one of the factor levels (criteria) significantly affects the choice of supplier more than the others. The resulting model is shown in the ANOVA table below (Table C11).

Table C11 ANOVA Table for the evaluating main criteria (UAE)

Source	Sum of Squares	df	Mean Square	F-Value	p-value	
Model	0.34	8	0.043	30.21	< 0.0001	significant
A-Evaluating Criteria	0.34	8	0.043	30.21	< 0.0001	
Pure Error	0.63	441	1.418E-003			
Cor Total	0.97	449				

As shown from the ANOVA, the model p-value is extremely small (<0.0001) and thus can be assumed to be significant, which indicates that at least one of the factor levels (criteria) is significantly different than the rest in the choice of supplier.

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation to the ANOVA assumptions as shown in Figures C31 and C32.

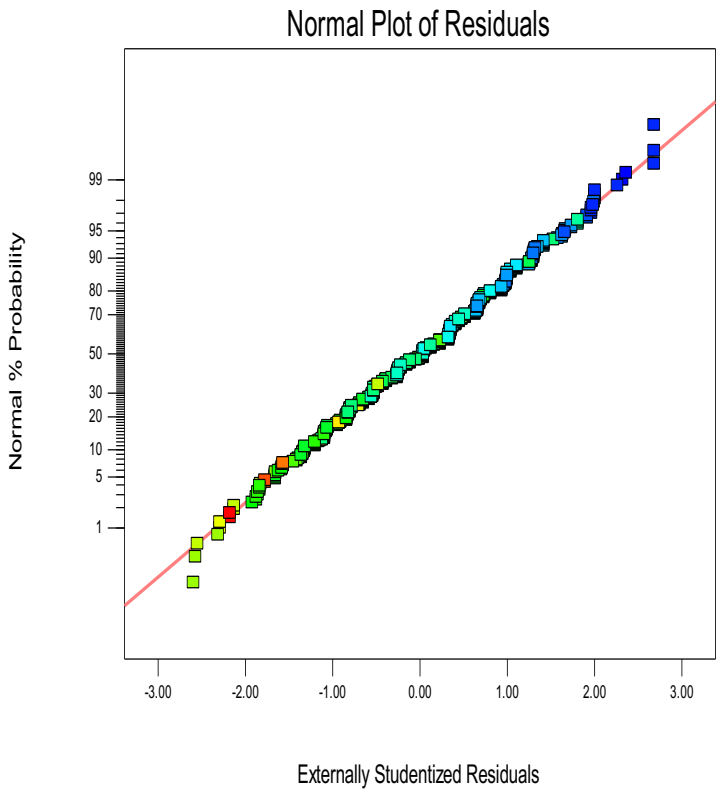


Figure C31 Normal Probability Plot

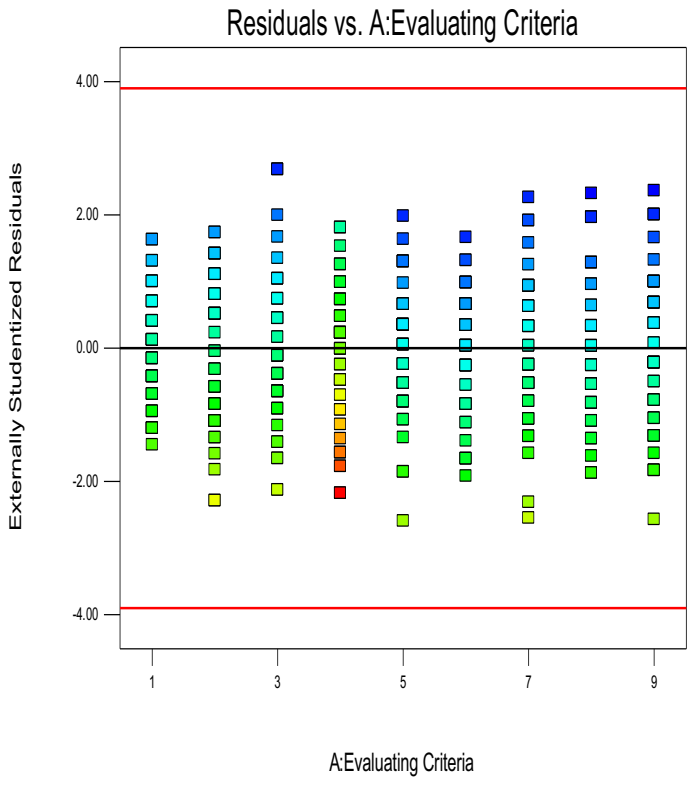


Figure C32 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C31, nearly all the plotted points can be represented by a straight line. This means that the residuals follow a normal distribution. The plot of the residual versus its evaluating criteria, Figure C32, shows that the errors have approximately constant variance and that the data contain no outliers. Thus, the diagnostic examination for the residual revealed no violations of the ANOVA underlying assumptions, which mean that the ANOVA results can be trusted. Therefore, as indicated in Table C11, the model is significant at a significance level of less than 0.0001.

It is worth saying that the original residual data required transformation into the inverse of square root transformation function to be able to ensure that the data followed a normal distribution with constant variance.

- Model Graphs

Currently, we have reached the conclusion that not all the evaluating criteria equally affect the choice of suppliers with respect to decision makers (buyers) from the UAE. It is crucial now to indicate which criterion is significantly more important from the buyer's (decision maker's) point of view. This can be revealed from the LSD plot shown in Figure C33 below.

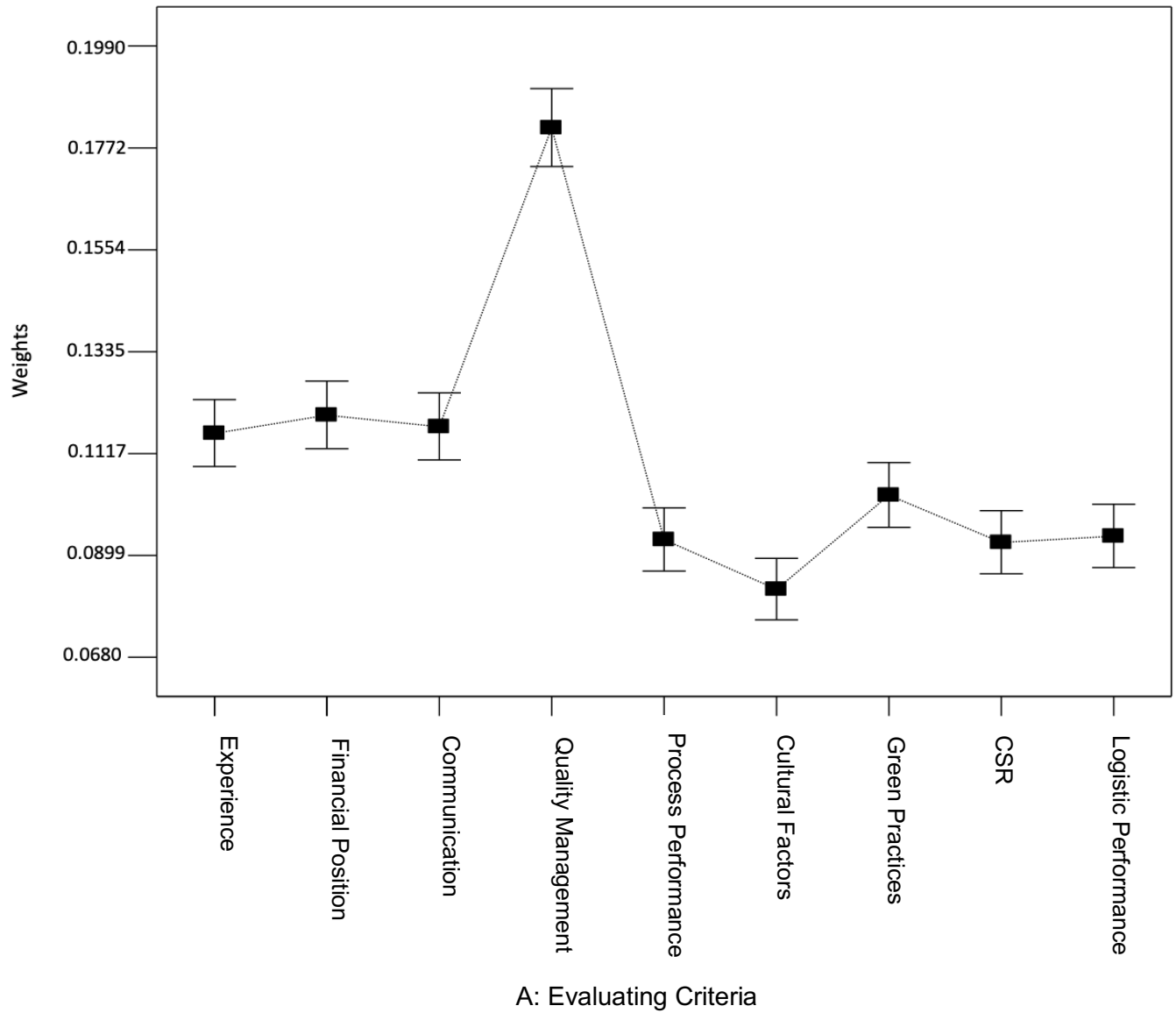


Figure C33 LSD Plot

The LSD plot shows that the most important criterion is quality management. Buyers from the UAE care much more about whether or not the supplier has a quality management system in place than any other criterion. Following this, three criteria come next that are almost equally important: supplier financial position, supplier experience, and supplier communication and responsiveness. From an UAE buyer's point of view, the remaining five evaluating criteria (process performance, supplier cultural factors, supplier green practice, supplier corporate social responsibility, CSR and supplier logistics) are significantly less important than the other four mentioned above. This highlights the fact that buyers from the UAE do not care a great deal about whether their suppliers focus on CSR and cultural factors.

- UAE sub-criteria

From the analysis of variance, all criteria will be evaluated to decide whether any sub-criteria are more important than others. The resulting model is shown in the ANOVA tables below (Tables C12 to C20) for each criterion available in the current research framework.

1. **Supplier Experience**
    - ANOVA

As shown from the ANOVA (Table C12), the model's p-value is small (< 0.0001) and thus it can be assumed to be significant, which indicates that the importance of these sub-criteria of the supplier experience criterion varies significantly among UAE decision makers in the decision over the choice of a supplier.

Table C12 ANOVA Table for Supplier Experience

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	4.86	5	0.9714	19.54	< 0.0001	significant
A-Supplier Experience	4.86	5	0.9714	19.54	< 0.0001	
Pure Error	14.61	294	0.0497			
Cor Total	19.47	299				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions, as shown in Figures C34 and C35.

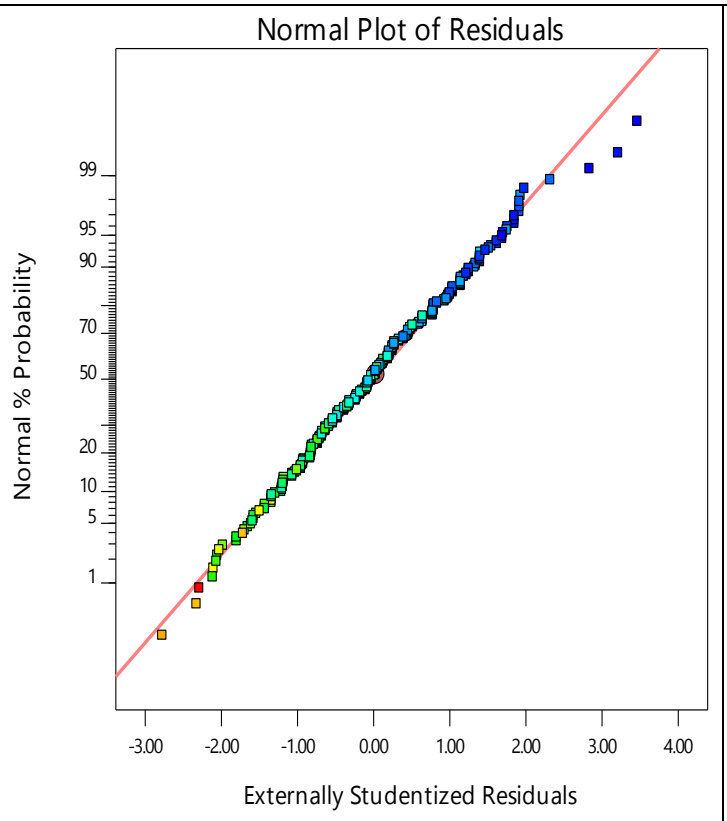


Figure C34 Normal Probability Plot

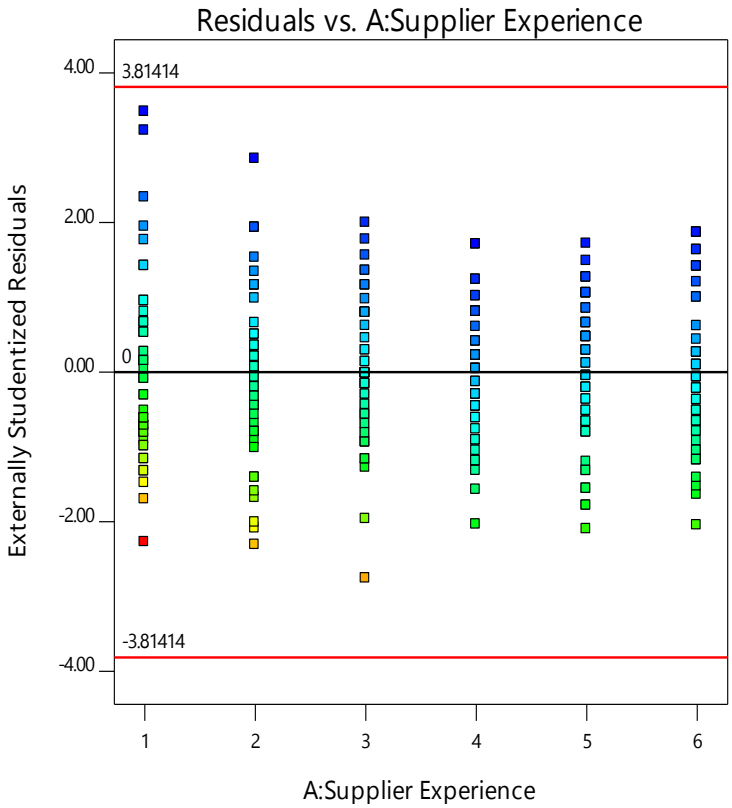


Figure C35 Residual vs. Evaluating Criteria

As shown by the normal probability plot in Figure C34, nearly all of the plotted points can be represented by a straight line. This means that the residuals approximately follow a normal distribution. The plot of the residual versus its evaluating criteria, shown in Figure C35, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C12, the model is significant at a significance level less than 0.0001.

- Model Graphs

Currently, we have reached the conclusion that the sub-criteria under the supplier experience criterion are not equally evaluated by decision makers (buyers) from the UAE when choosing a supplier. It is crucial now to indicate which sub-criterion is significantly more preferred from the UAE buyers' point of view; this can be revealed from the LSD plot shown in Figure C36.

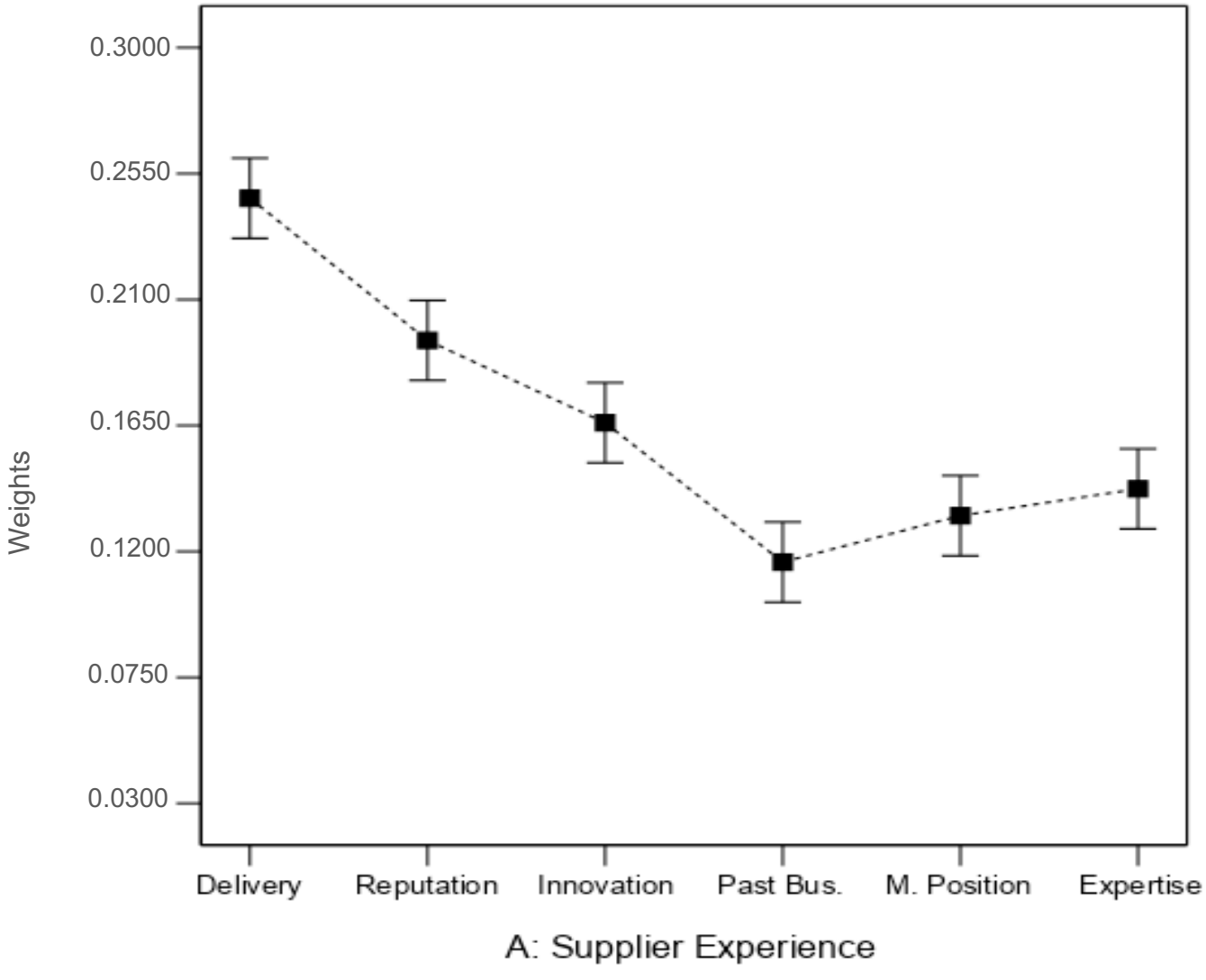


Figure C36 LSD Plot

The LSD plot shows that the performance history and delivery sub-criterion is the most important for UAE decision makers in supplier selection, followed by reputation and then

the innovation and creativity criterion. The other three sub-criteria (supplier expertise, marketing position and amount of past business) are less important.

2. Supplier's Financial Position

- ANOVA

As shown from the ANOVA (Table C13), the model p-value is small (< 0.0001) and thus it can be assumed to be significant, which indicates that the importance of these sub-criteria of the supplier financial position criterion varies significantly among UAE decision makers in the decision over the choice of a supplier.

Table C13 ANOVA Table for Supplier Financial Position

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.3057	4	0.0764	44.46	< 0.0001	significant
A-Financial Position	0.3057	4	0.0764	44.46	< 0.0001	
Pure Error	0.4212	245	0.0017			
Cor Total	0.7269	249				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions, as shown in Figures C37 and C38.

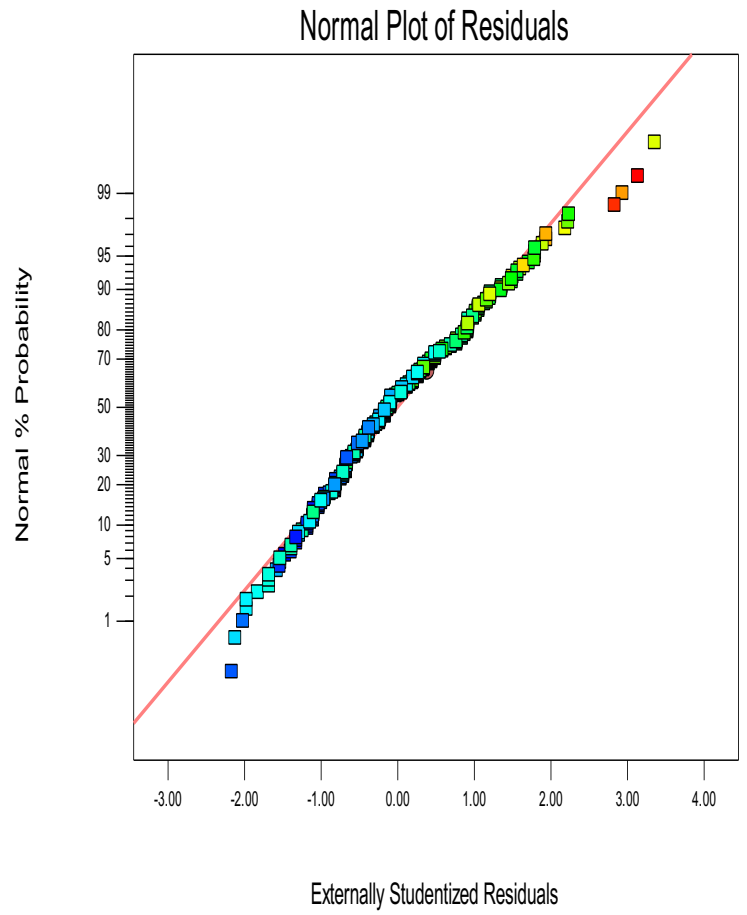


Figure C37 Normal Probability Plot

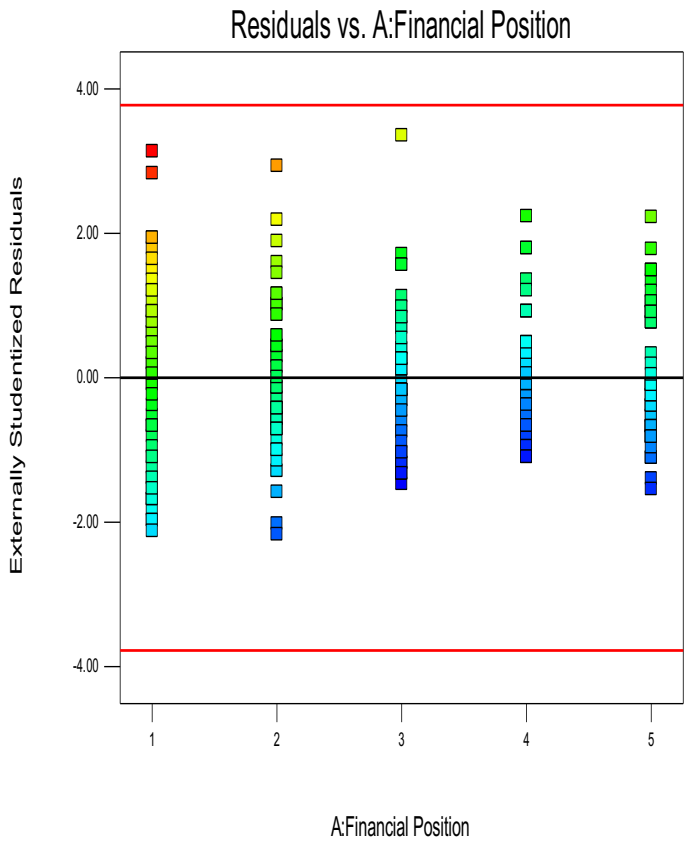


Figure C38 Residual vs. Evaluating Criteria

As shown by the normal probability plot in Figure C37, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria, shown in Figure C38, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C13, the model is significant at a significance level of less than 0.0001.

- Model Graphs

Currently, we have reached the conclusion that all the sub-criteria under the supplier financial position criterion are not equally evaluated by decision makers (buyers) from UAE when choosing a supplier. It is crucial now to indicate which sub-criterion is

significantly more preferred from the UAE buyers' point of view. This can be revealed from the LSD plot shown in Figure C39 below.

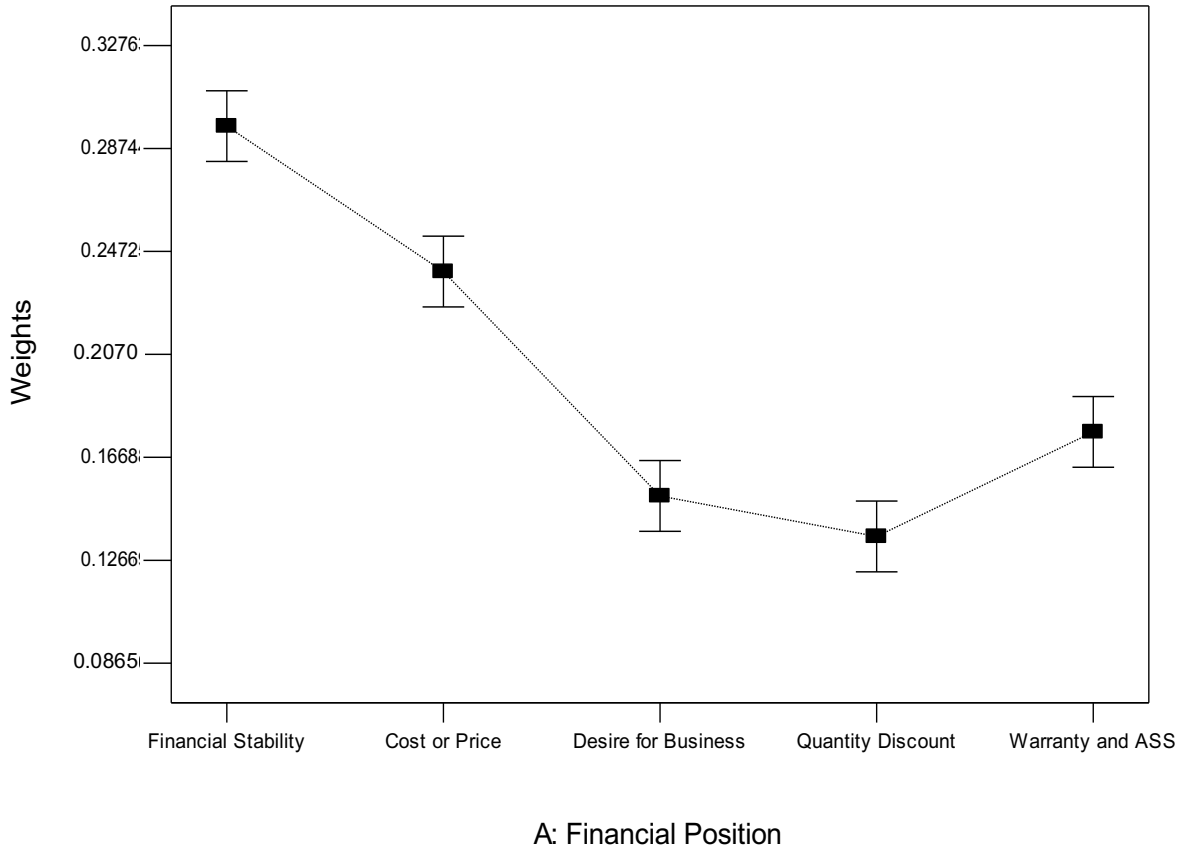


Figure C39 LSD Plot

The LSD plot shows that the financial stability sub-criterion is most important for UAE decision makers in supplier selection. Following this sub-criterion, the cost or price sub-criterion is ranked next in importance. The rest of the sub-criteria (warranty and aftersales services, desire for business and quantity discount) are less important.

3. Communication and Responsiveness

- ANOVA

As shown from the ANOVA (Table C14), the model's p-value is extremely small (<0.0001) and thus it can be assumed to be significant, which indicates that the importance of the

sub-criteria under communication and responsiveness varies significantly among UAE decision makers in the decision over the choice of a supplier.

Table C14 ANOVA Table for Communication and Responsiveness

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.1366	4	0.0341	14.89	< 0.0001	significant
A-Communication and Responsiveness	0.1366	4	0.0341	14.89	< 0.0001	
Pure Error	0.5617	245	0.0023			
Cor Total	0.6983	249				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions, as shown in Figures C40 and C41.

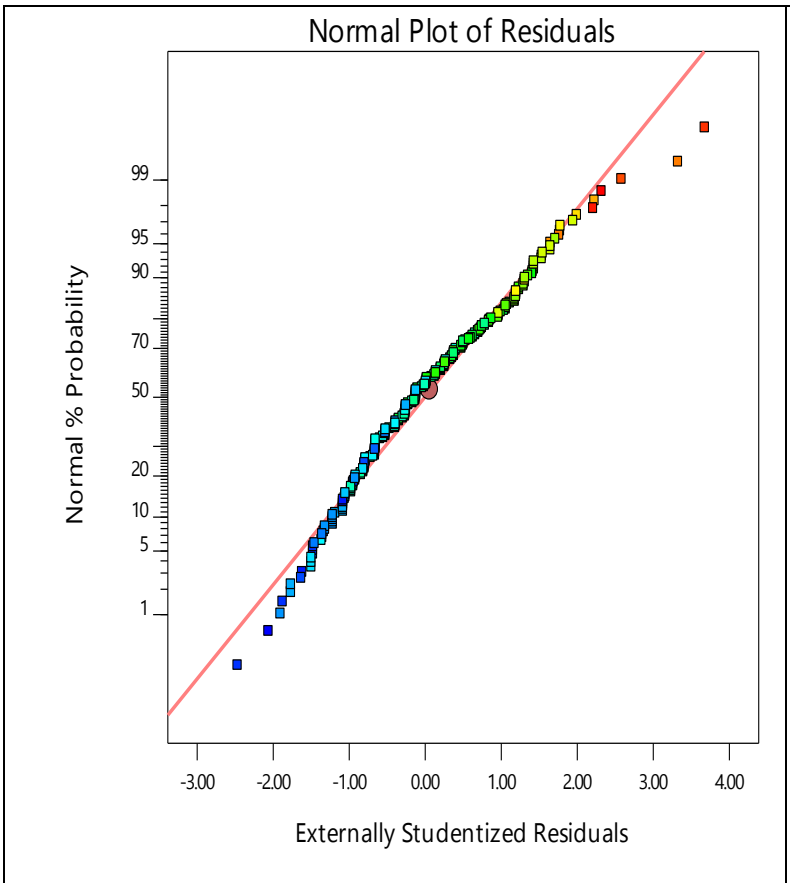


Figure C40 Normal Probability Plot

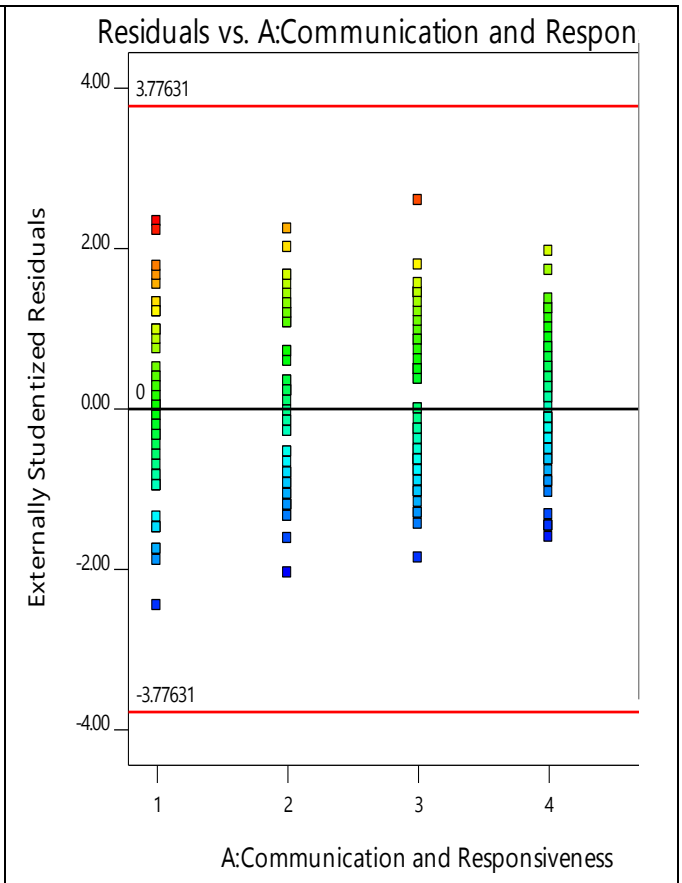


Figure C41 Residual vs. Evaluating Criteria

As shown in the normal probability plot in Figure C40, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria, shown in Figure C41, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C14, the model is significant at a significance level equal to less than 0.0001. This means that not all of the sub-criteria under the communication and responsiveness criterion are equally important from UAE buyers' perspective.

- Model Graphs

Currently, we have reached the conclusion that the sub-criteria of communication and responsiveness are not equally evaluated by decision makers (buyers) from UAE in their choice of suppliers. It is crucial now to indicate which sub-criterion is significantly more preferred from the UAE buyers' point of view. This can be revealed from the LSD plot shown in Figure C42 below.

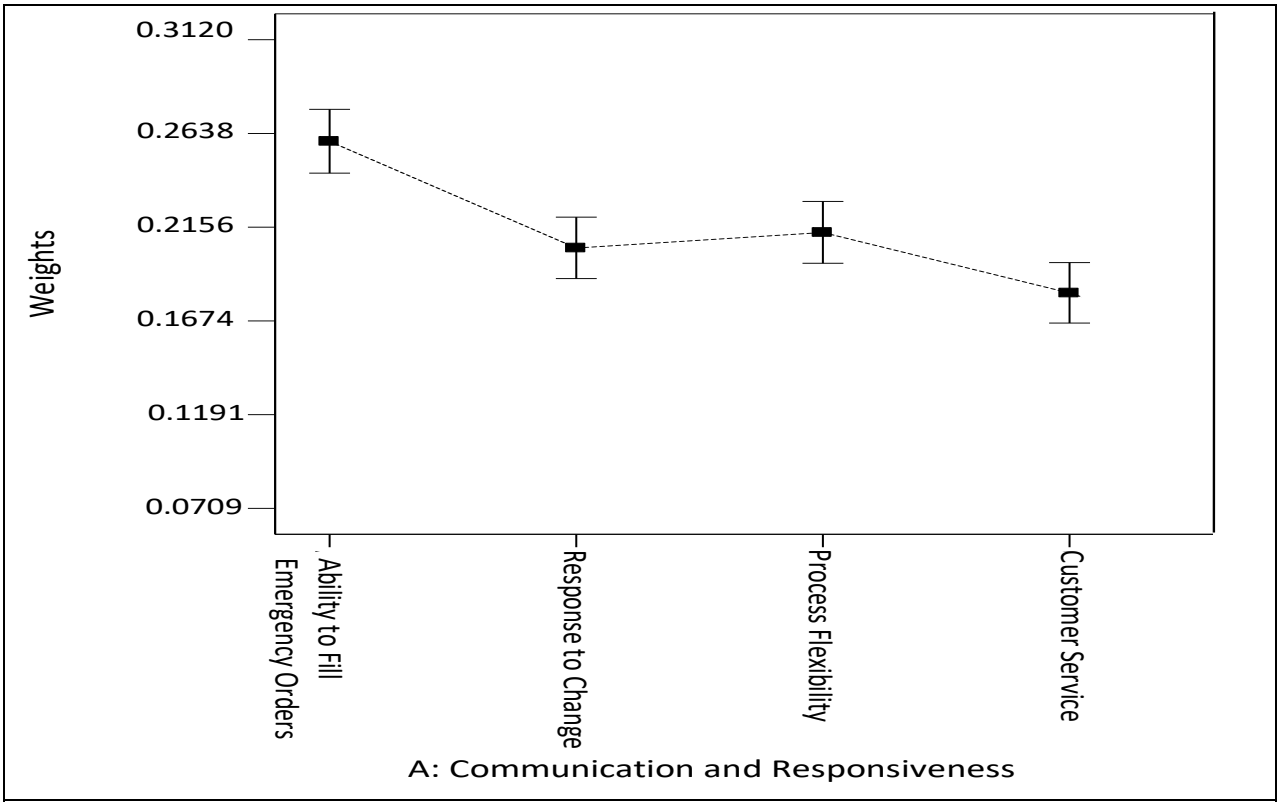


Figure C42 LSD Plot

The LSD plot shows that ability to fill emergency orders is the most important sub-criterion for UAE buyers in the supplier selection decision.

4. Quality Management

- ANOVA

As shown from the ANOVA (Table C15), the model's p-value is small (< 0.0001) and thus it can be assumed to be significant, which indicates that the importance of those sub-criteria under the quality management criterion varies significantly among UAE decision makers in the decision over the choice of a supplier.

Table C15 ANOVA Table for Quality Management

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	5.30	5	1.06	34.07	< 0.0001	significant
A-Quality Management	5.30	5	1.06	34.07	< 0.0001	
Pure Error	9.15	294	0.0311			
Cor Total	14.45	299				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions, as shown in Figures C43 and C44.

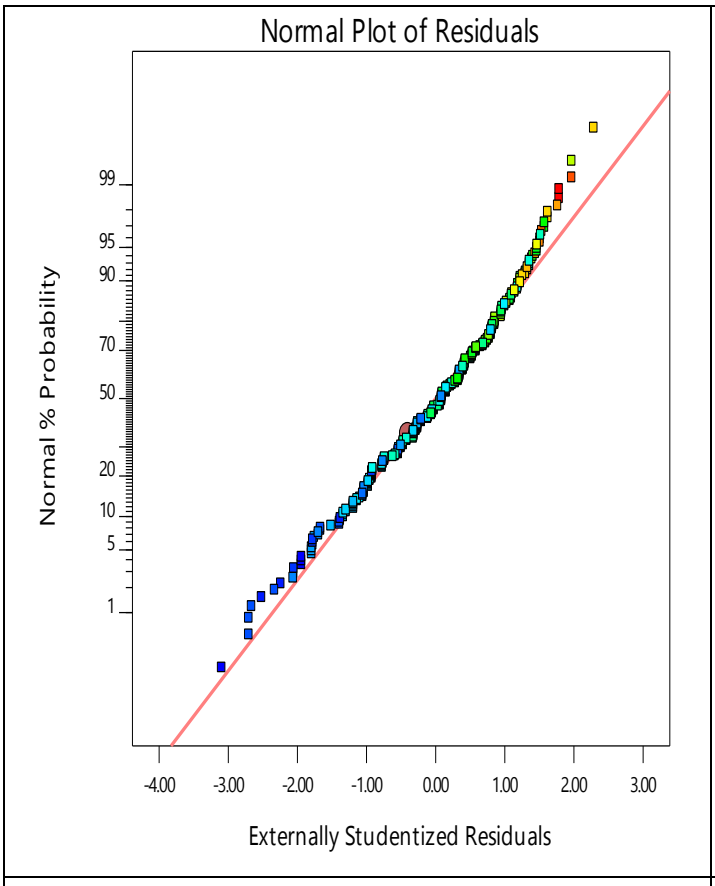


Figure C43 Normal Probability Plot

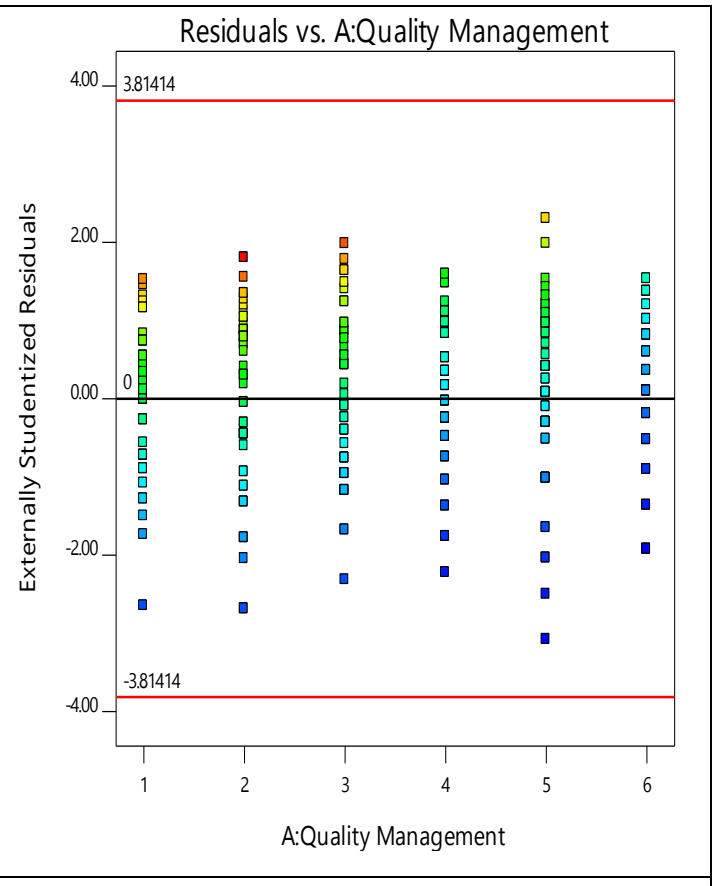


Figure C44 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C43, nearly all the plotted points can be represented by a straight line. This means that the residuals plot follows an approximately normal distribution. The plot of the residual versus its evaluating criteria, shown in Figure C44, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C15, the model is significant at a significance level of less than 0.0001.

- Model Graphs

Currently, we have reached the conclusion that the sub-criteria under the supplier quality management criterion are not equally evaluated by decision makers (buyers) from the UAE when choosing a supplier. It is crucial now to indicate which sub-criterion is

significantly more preferred from the UAE buyers' point of view. This can be revealed from the LSD plot shown in Figure C45 below.

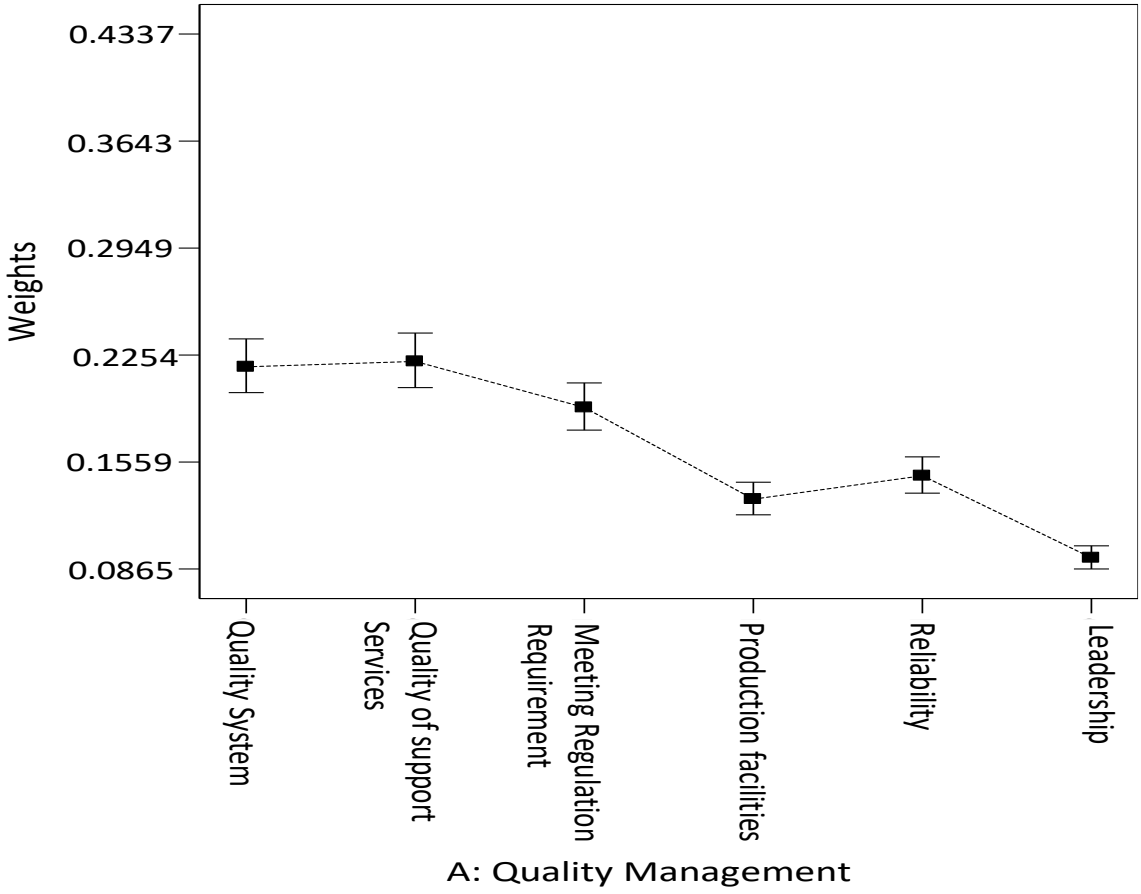


Figure C45 LSD Plot

The LSD plot shows that the quality of support services criterion is the most important for UAE decision makers in supplier selection, followed by quality system and meeting regulatory requirements. The other three sub-criteria (reliability, production facilities and capabilities, and organisational leadership) are less important, with the latter being the least important.

5. Process Performance

- ANOVA

As shown from the ANOVA Table C16, the model p-value is small (<0.0001) and thus it can be assumed to be significant, which indicates that the importance of those sub-

criteria under the process performance criterion varies significantly among UAE decision makers in the decision over the choice of a supplier.

Table C16 ANOVA Table for Process Performance

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0891	4	0.0223	8.30	< 0.0001	significant
A-Process Performance	0.0891	4	0.0223	8.30	< 0.0001	
Pure Error	0.6578	245	0.0027			
Cor Total	0.7469	249				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions, as shown in Figures C46 and C47.

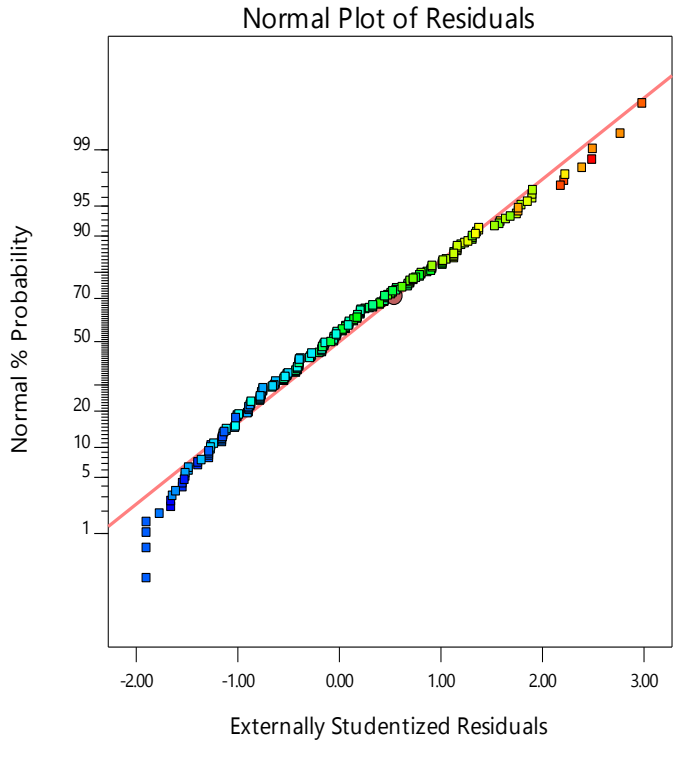


Figure C46 Normal Probability Plot

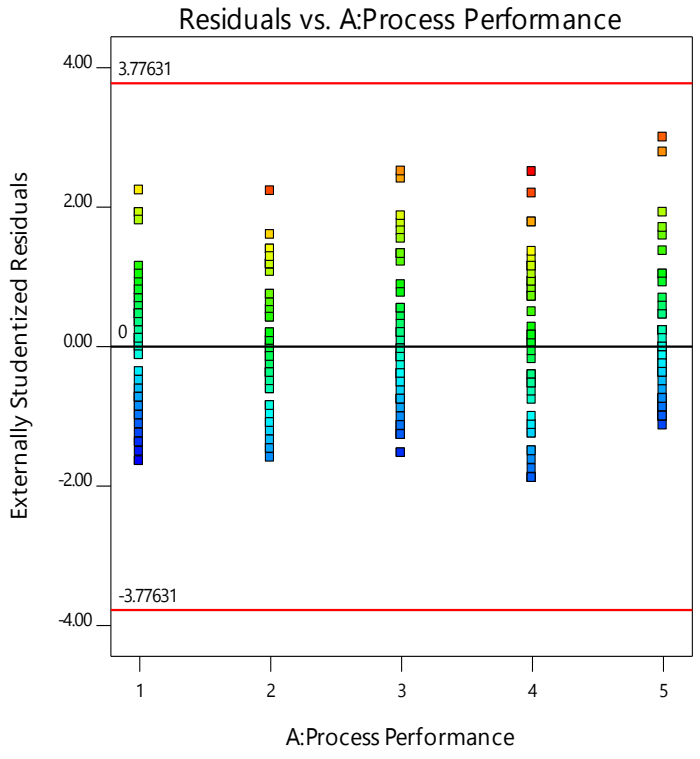


Figure C47 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C46, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria, shown in Figure C47, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C16, the model is significant at a significance level of less than 0.0001.

- Model Graphs

Currently, we have reached the conclusion that the sub-criteria under the process performance criterion are not equally evaluated in the choice of suppliers with respect to decision makers (buyers) from the UAE. It is crucial now to indicate which sub-criterion is significantly more preferred from the UAE buyers' point of view. This can be revealed from the LSD plot shown in Figure 48 below. This conclusion matches the output of the ANOVA shown in Table C16 above.

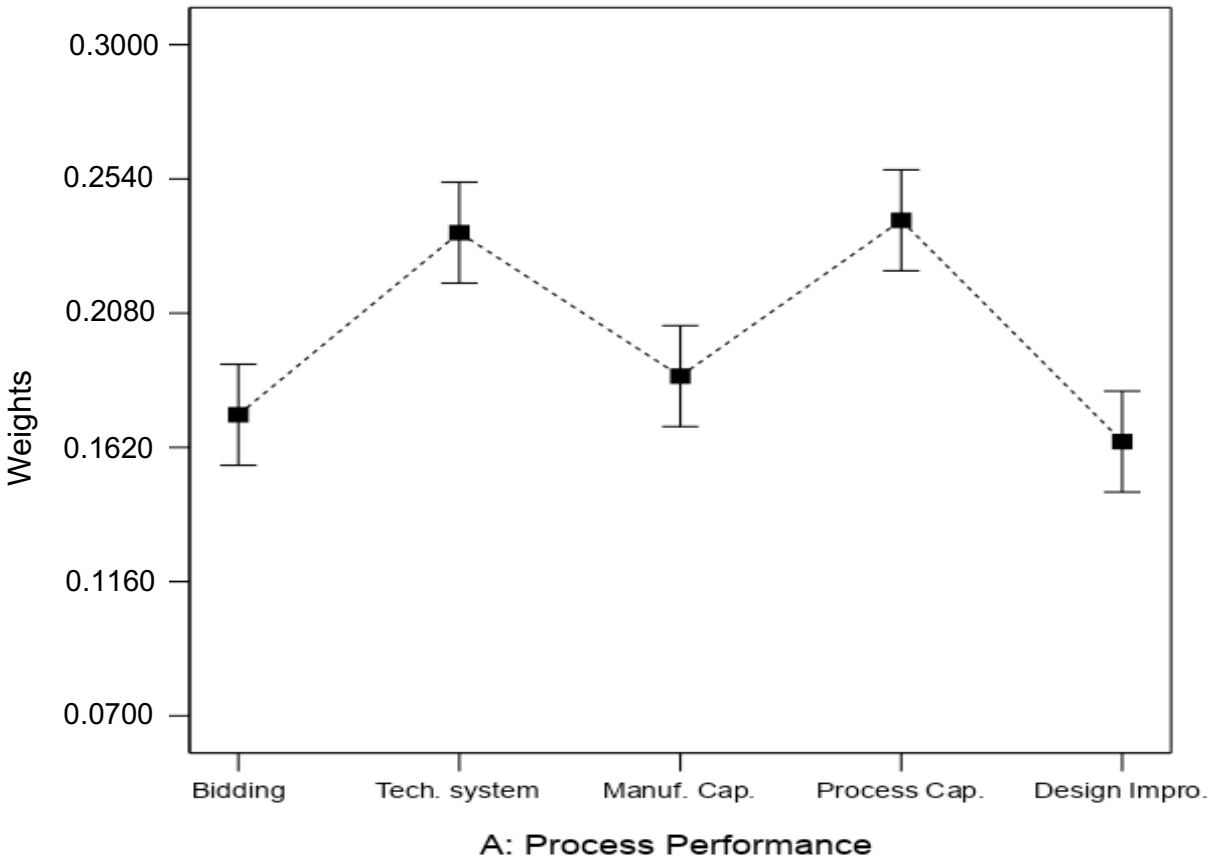


Figure C48 LSD Plot

The LSD plot shows that process capability, as well as technological system and technical support, are the most important sub-criteria for UAE decision makers in supplier selection. The other sub-criteria (future manufacturing capability, bidding process and design/process improvement) are equally important, but less important than the two above-mentioned sub-criteria.

6. Cultural Factors

- ANOVA

As shown from the ANOVA (Table C17), the model's p-value is small (<0.0020) and thus it can be assumed to be significant, which indicates that the importance of those sub-criteria under the cultural factors criterion varies significantly among UAE decision makers in the decision over the choice of a supplier.

Table C17 ANOVA Table for Cultural Factors

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.1069	2	0.0535	6.49	0.0020	significant
A-Cultural Factors	0.1069	2	0.0535	6.49	0.0020	
Pure Error	1.21	147	0.0082			
Cor Total	1.32	149				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions, as shown in Figures C49 and C50.

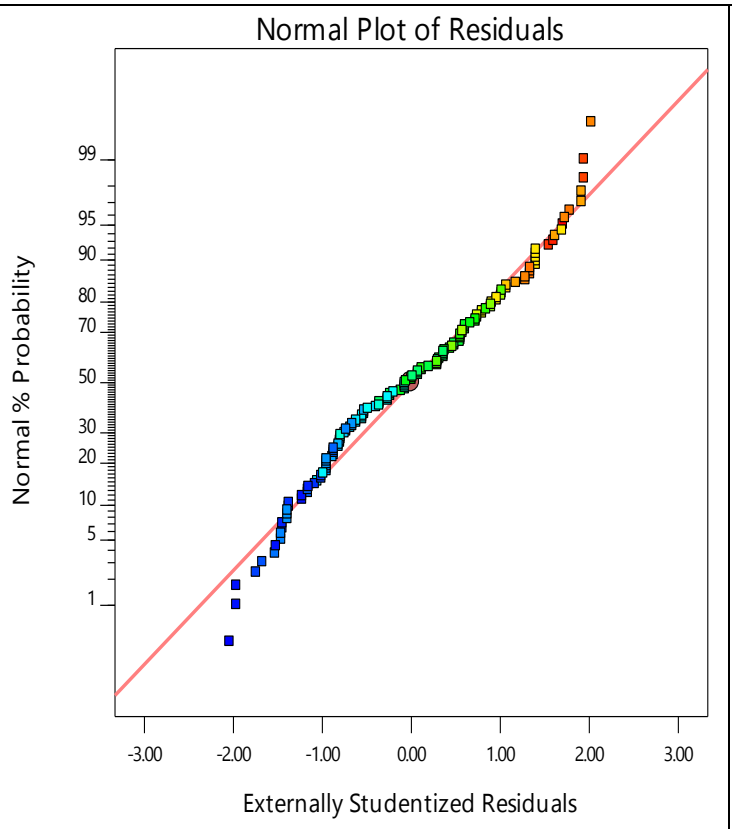


Figure C49 Normal Probability Plot

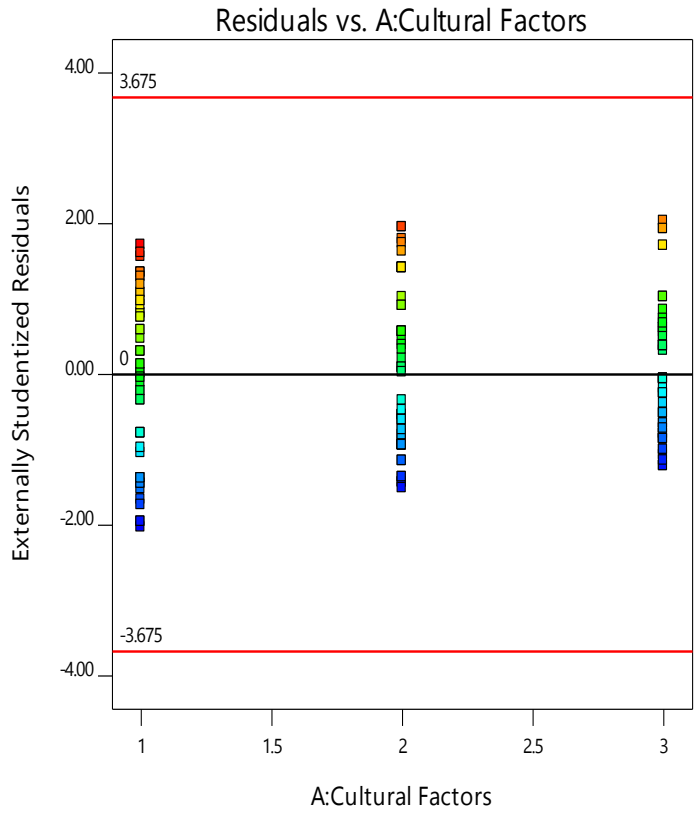


Figure C50 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C49, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately

normal distribution. The plot of the residual versus its evaluating criteria, shown in Figure C50, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C17, the model is significant at a significance level equal to 0.0020.

- Model Graphs

Currently, we have reached the conclusion that the sub-criteria under the cultural factors criterion are not equally evaluated by decision makers (buyers) from the UAE. It is crucial now to indicate which sub-criterion is significantly more preferred from the UAE buyers' point of view. This can be revealed from the LSD plot shown in Figure C51 below. This conclusion matches the output of the ANOVA shown in Table C17 above.

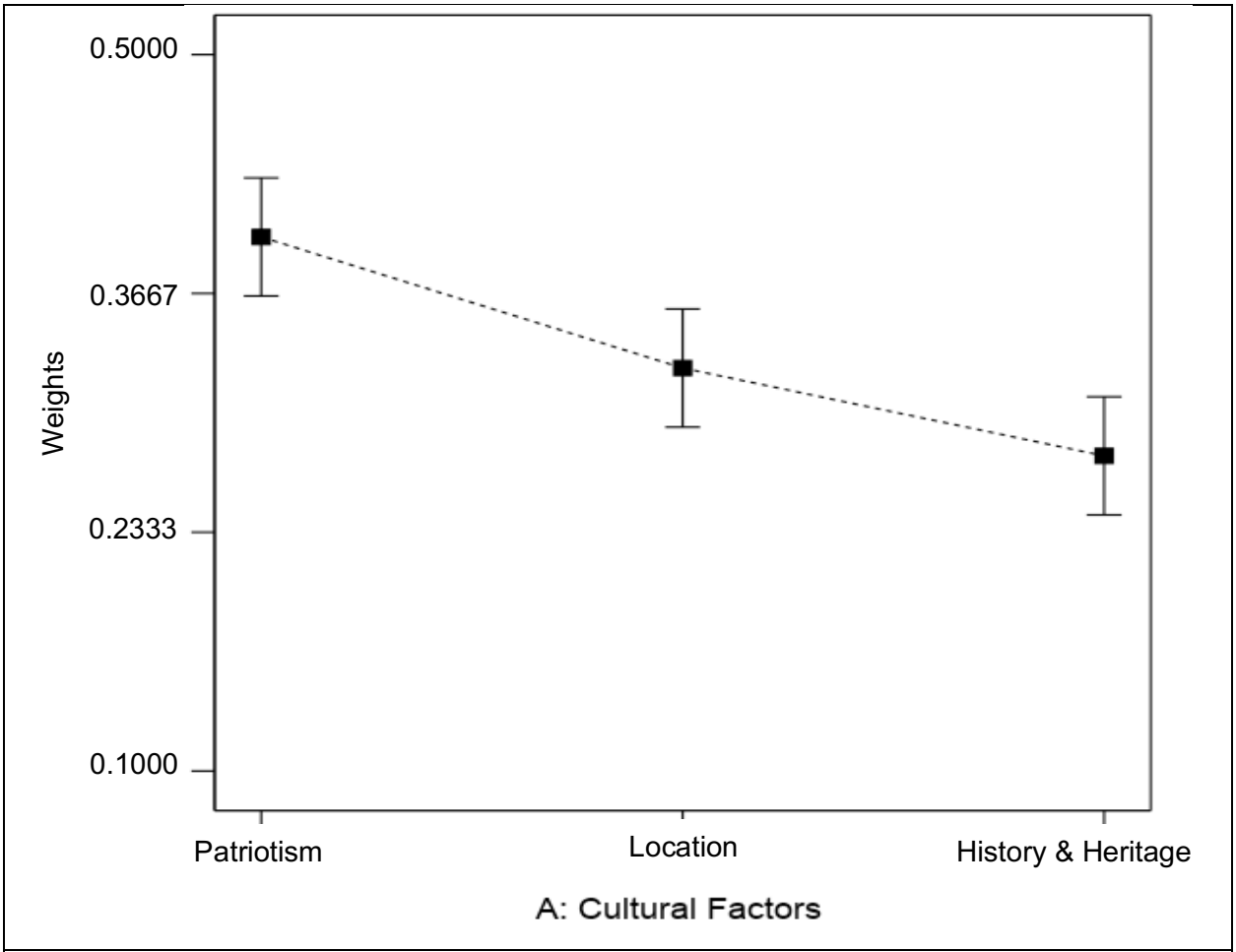


Figure C51 LSD Plot

The LSD plot shows that the patriotism for same culture and beliefs criterion is most important for UAE decision makers in supplier selection. In addition, the two other sub-criteria (admiring history and heritage, and location, local or foreign) have approximately the same importance from the UAE buyers' point of view, with admiring history and heritage being the least important.

7. Green Practices

- ANOVA

As shown from the ANOVA (Table C18), the model's p-value is small (0.0020) and thus it can be assumed to be significant, which indicates that the importance of those sub-criteria under the green practices criterion varies significantly among UAE decision makers in the decision over the choice of a supplier.

Table C18 ANOVA Table for Green Practices

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	1.00	3	0.3349	5.12	0.0020	significant
A-Green Practices	1.00	3	0.3349	5.12	0.0020	
Pure Error	12.81	196	0.0654			
Cor Total	13.82	199				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions, as shown in Figures C52 and C53.

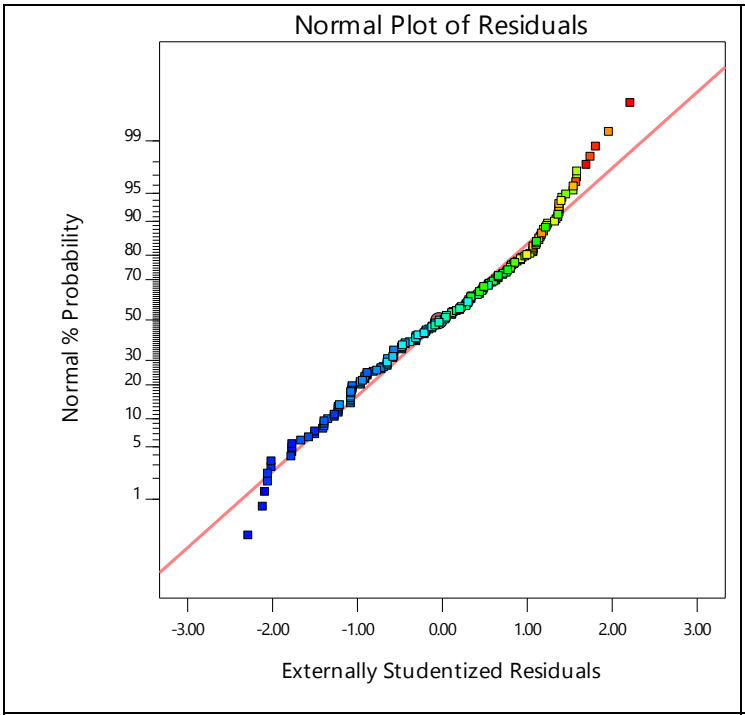


Figure C52 Normal Probability Plot

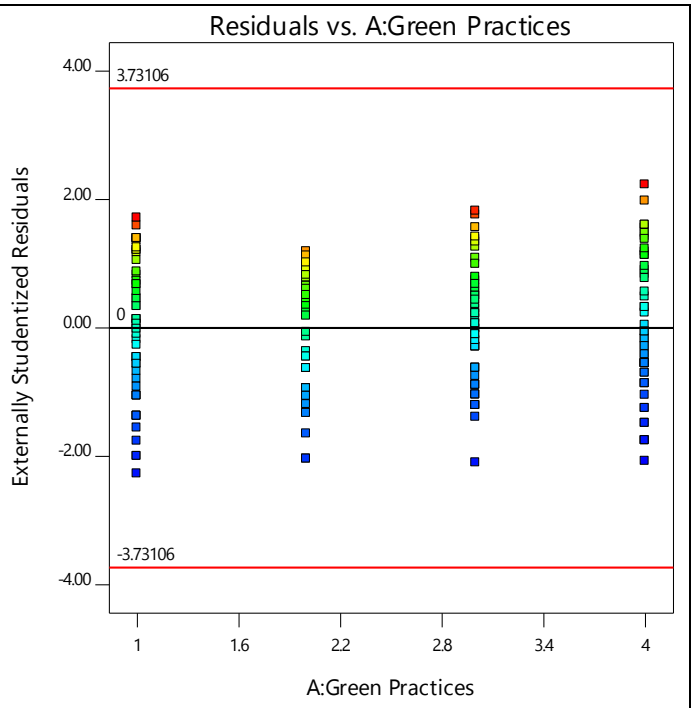


Figure C53 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C52, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria, shown in Figure C53, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C18, the model is significant at a significance level equal to 0.0020.

- Model Graphs

Currently, we have reached the conclusion that the sub-criteria under the green practices criterion are not equally evaluated by decision makers (buyers) from the UAE when choosing a supplier. It is crucial now to indicate which sub-criterion is significantly more preferred from the UAE buyers' point of view. This can be revealed from the LSD plot shown in Figure C54 below. This conclusion matches the output of the ANOVA shown in Table C18 above.

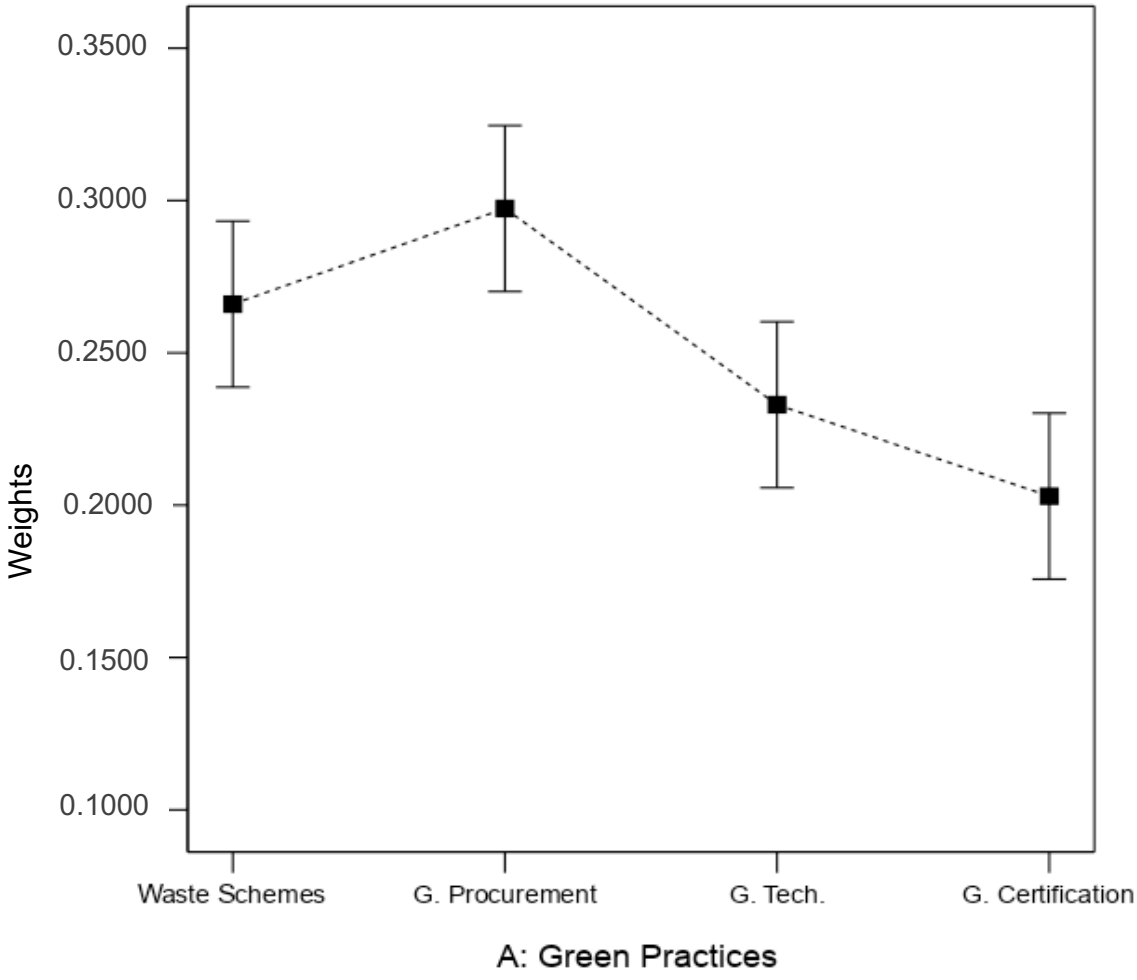


Figure C54 LSD Plot

The LSD plot shows that the green procurement criterion is the most important for UAE decision makers in supplier selection.

8. CSR

- ANOVA

As shown from the ANOVA (Table C19), the model p-value is small (<0.0001) and thus it can be assumed to be significant, which indicates that the importance of those sub-criteria under the CSR criterion varies significantly among UAE decision makers in the decision over the choice of a supplier.

Table C19 ANOVA Table for CSR

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.3852	4	0.0963	6.88	< 0.0001	significant
A-CSR	0.3852	4	0.0963	6.88	< 0.0001	
Pure Error	3.43	245	0.0140			
Cor Total	3.81	249				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions, as shown in Figures C55 and C56.

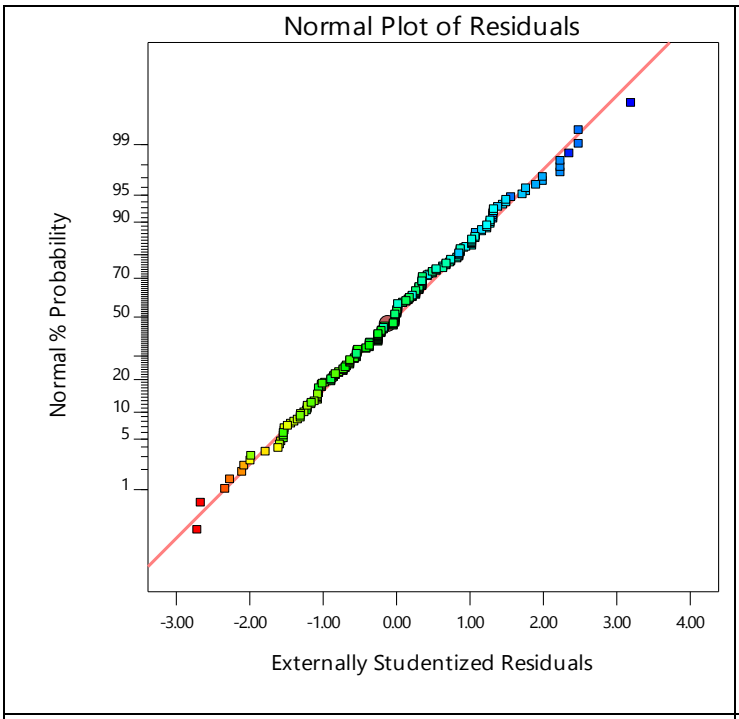


Figure C55 Normal Probability Plot

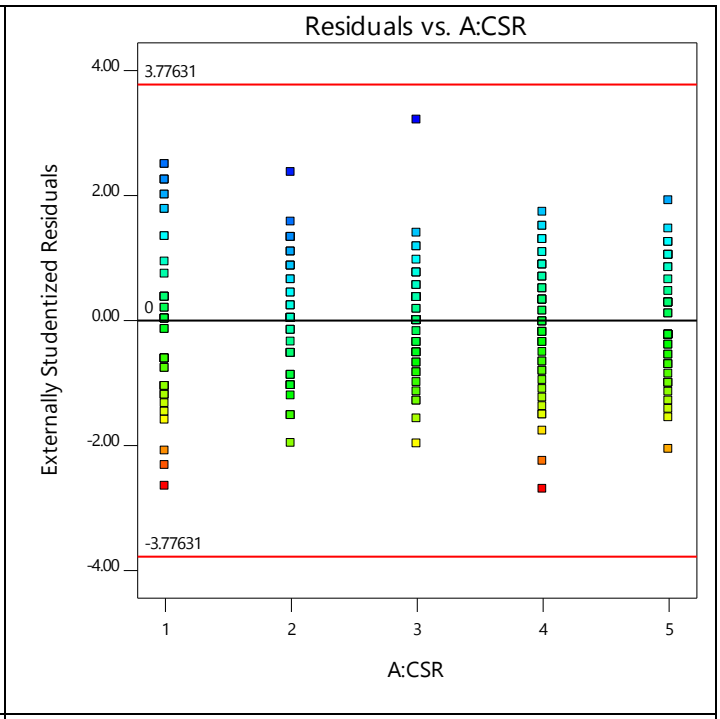


Figure C56 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C55, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria, shown in Figure C56, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted.

Therefore, as indicated in Table C19, the model is significant at a significance level equal to less than 0.0001.

- Model Graphs

Currently, we have reached the conclusion that the sub-criteria under the CSR criterion are not equally evaluated by decision makers (buyers) from the UAE when choosing a supplier. It is crucial now to indicate which sub-criterion is significantly more preferred from the UAE buyers' point of view. This can be revealed from the LSD plot shown in Figure C57 below.

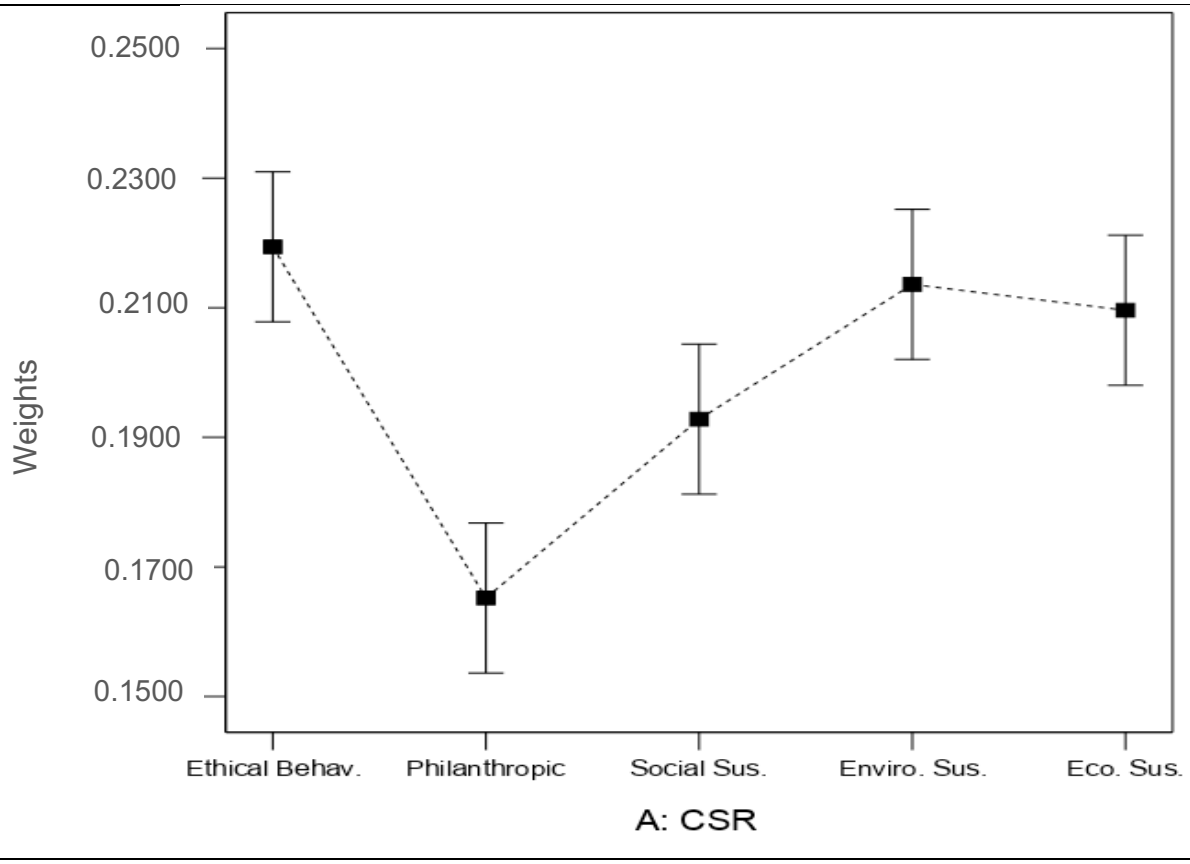


Figure C57 LSD Plot

The LSD plot shows that the ethical behaviour criterion is the most important for UAE decision makers in supplier selection. However, environmental, economic and social sustainability are as important as ethical behaviour. The least important sub-criterion is philanthropic responsibility.

9. Supplier Logistics Performance

- ANOVA

As shown from the ANOVA (Table C20), the model's p-value is small (< 0.0001) and thus it can be assumed to be significant, which indicates that the importance of those sub-criteria under the logistics performance criterion varies significantly among UAE decision makers in the decision over the choice of a supplier.

Table C20 ANOVA Table for Supplier Logistics Performance

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.8104	4	0.2026	7.20	< 0.0001	significant
A-Logistics Performance	0.8104	4	0.2026	7.20	< 0.0001	
Pure Error	6.90	245	0.0282			
Cor Total	7.71	249				

- Model Adequacy Check

To be able to trust the above ANOVA results, model graphics should be visually tested for any violation of the ANOVA assumptions, as shown in Figures C58 and C59. It is worth saying that the model required transformation into square root in order for the residuals to follow an approximately normal distribution with constant variance.

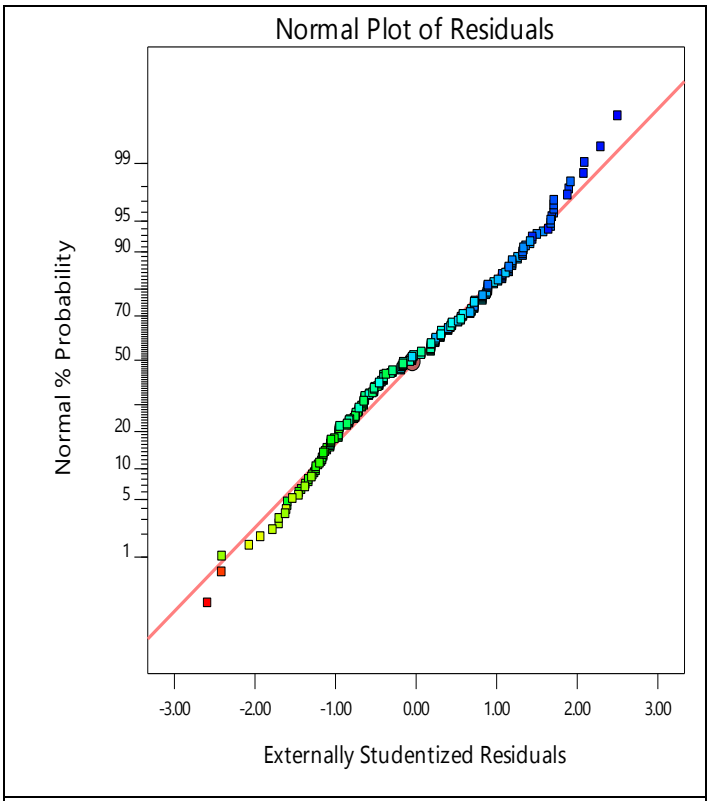


Figure C58 Normal Probability Plot

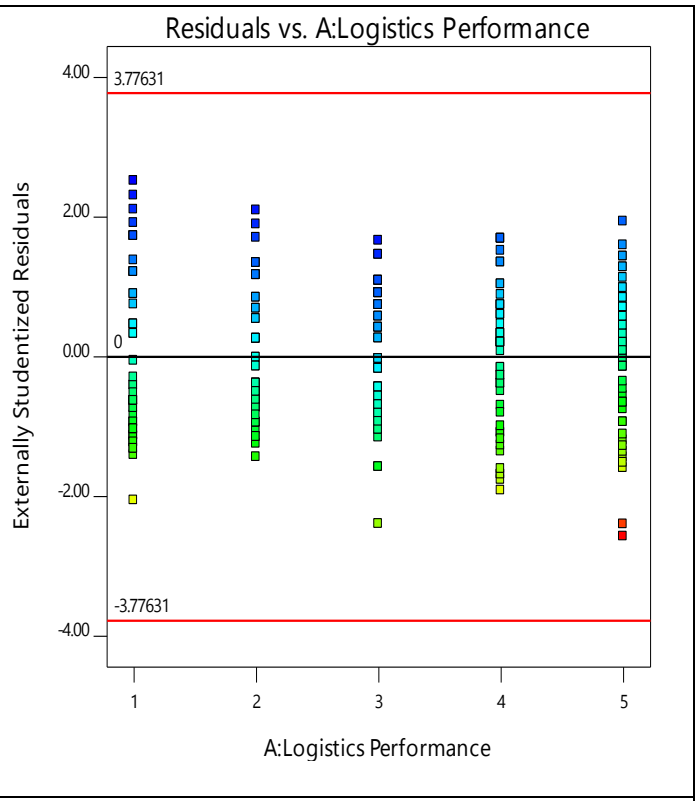


Figure C59 Residual vs. Evaluating Criteria

As per the normal probability plot, Figure C58, nearly all the plotted points can be represented by a straight line. This means that the residuals follow an approximately normal distribution. The plot of the residual versus its evaluating criteria, shown in Figure C59, shows that the errors have approximately constant variance and the data contain no outliers. Thus, the diagnostic examination of the residual revealed no violations of the ANOVA underlying assumptions, which means that the ANOVA results can be trusted. Therefore, as indicated in Table C20, the model is significant at a significance level of less than 0.0001.

- Model Graphs

Currently, we have reached the conclusion that all the sub-criteria under the supplier logistic performance criterion are not equally evaluated by decision makers (buyers) from the UAE when choosing a supplier. It is crucial now to indicate which sub-criterion is

significantly more preferred from the UAE buyers' point of view. This can be revealed from the LSD plot shown in Figure C60 below.

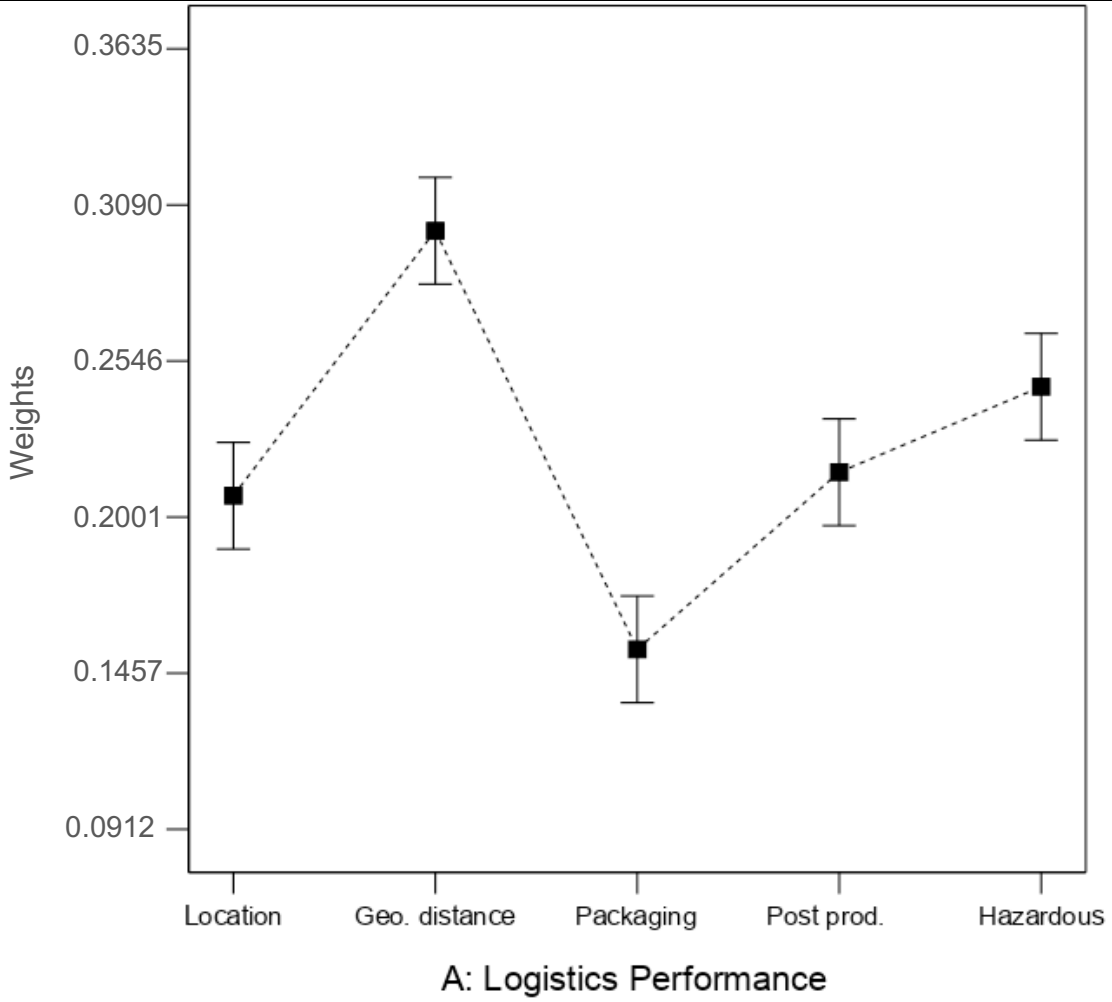


Figure C60 LSD Plot

The LSD plot shows that geographical distance followed by hazardous goods management are the most important for UAE decision makers in supplier selection. The other three sub-criteria (post-production configuration, location and packaging) are less important.

Appendix D The university ethical approval for conducting the research survey

CEMPS
College of Engineering, Mathematics and Physic
Harrison Building
The University of Exeter
Streatham Campus
North Park Road
Exeter
EX4 4QF
Web: www.exeter.ac.uk

CEMPS Ethics Committee

Dear Ousha Alshamsi

Ethics application - eEMPS000021
Survey Ethical Approval

Your project has been reviewed by the CEMPS Ethics Committee and has received a Favourable opinion.

The Committee has made the following comments about your application:
David Zhang commented, approved

You are required to re-submit for full review/confirm that comments have been addressed before you begin your research.

If you have any further queries, please contact your Ethics Officer.

Yours sincerely

Date: 09/03/2018

CEMPS Ethics Committee